

THE
COMMENTARIES
UPON THE
APHORISMS

OF
Dr. HERMAN BOERHAAVE,

The late Learned Professor of Physic in the
University of LEYDEN.

CONCERNING
The KNOWLEDGE and CURE of the several
DISEASES incident to HUMAN BODIES.

By GERARD VAN SWIETEN, M. D.

Translated into ENGLISH.

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REPORT

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LAND REVENUE

FOR THE YEAR 1840

BY GEORGE



THE SECOND PART

OF THE

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LAND REVENUE

FOR THE YEAR 1840

T H E
P R E F A C E.

TO attempt an encomium on Dr. Boërhaave, or his Aphorisms, might be deservedly esteemed an unprofitable labour, as the reputation both of the author and his performance is at present so well established, that their fame may be justly said to have extended already to the utmost corners of the earth.

This production was first sent abroad in Latin, at Leyden, in 1708, about seven years after Dr. Boërhaave had officiated as Lecturer in the university, and the year before his advancement to the Professor's chair. It has since bore four impressions in its original, and been translated into the most considerable of the modern languages, into English, French, and Arabick, being one of the first books, that by order of the Musti was printed at Constantinople in the new erected press, which not many years ago was set up there by the authority of the Grand Vizir.

It was preceded in 1707, by our author's *Institutiones Medicæ*, and bears this relation to it, that as the former comprehended the theory, so this latter takes in the whole practice of physick. Dr. Boërhaave's design in both, was to furnish his pupils with a summary of the several subjects, whereon he proposed to discourse more at large in the lectures he intended to give them.

iv The P R E F A C E.

And as every man has his particular way of thinking, and must of necessity be supposed to understand his own meaning better than another's, he the rather chose, as himself informs us *, to comment upon a work drawn up by himself, than to explain the writings of any other person, how eminent soever, as by this means he could not but express himself with the greater accuracy, and of consequence convey his sentiments with the greater ease and advantage into the minds of his hearers.

In compiling this work he has taken a great deal of pains to be as concise as possible; and, yet short as the whole is, we have here joined to the correct observations of the Greeks, whatever has been found to be useful among the Arabians, with the improvements of the Moderns superadded to both. From this conciseness however his performance has been censured as obscure. And indeed this circumstance seems to have been unavoidable from the nature of the work. For how was it possible, that so many and such important subjects should be included within so narrow a compass, and not be obscure? Besides, as Dr. Boërhaave only designed it for the text of his lectures, it seems as if he intended, that his explications should be necessary to make it well understood, especially by such, as were not already conversant in the art. For this reason his Commentaries have been greedily sought after, and even indirect methods taken to have them made publick.

About fifteen years ago there was printed at Amsterdam, under the name of Padua, a book
entituled

* Præfat. ad Institut. Medic.

The P R E F A C E. v

entituled *Praxis Medica, sive Commentarius in Aphorismos de cognoscendis & curandis morbis*, in five Volumes in 8vo. This was given out to contain the entire *dictata* of Dr. Boërhaave on his Aphorisms, as taken down from his own mouth by one of his scholars, who attended upon his private lectures. But whoever the writer was, this surreptitious performance, as we learn * from a good judge in this matter, was sent abroad “ so scandalously incorrect, as “ if the editor had neither understood the sub- “ ject nor the language, nor intended benefit “ to any except the proprietors of that edition.” Its defects, however, have been since supplied by the industry of Dr. Van Swieten, who, to prevent the like imposition upon the publick for the future, and at the same time to do justice to the memory of the learned compiler, has lately given us an accurate edition of part of this work, which he intends to compleat; and it is the fruit of his labours, that in the following sheets we have attempted to lay before the English reader.

This gentleman, who is now a Physician of great note at Leyden, and has long discharged the office of lecturer in pharmacy to the English students, was for near twenty years an auditor of Dr. Boërhaave, and, perhaps, the only one that was so, was admitted to a large share of his private conversation and friendship, and allowed to consult him with freedom upon every difficulty that occurred in any of his lectures. These were advantages in a manner peculiar to himself, and such as more particularly qualified him for success
in

* Life of Dr. Boërhaave, &c. pag. 118.

in this great undertaking. Nor does he seem to have declined any opportunity that could offer, whereby he might reflect honour to his master, or contribute to the benefit of his reader. It was Dr. Boërhaave's custom to confine the explanation of his Aphorisms to the short limits of a single year, and as he was very careful to inculcate the first principles of the science he was teaching into the understandings of his pupils, he found himself sometimes obliged to make a repetition of what he had before advanced, in favour of such of them, as were of a meaner capacity than the rest. By this means it frequently happened, that through want of time he was forced at the close of the year to cut short his discourse, and explain the last-handled subjects in a more hasty manner than agreed well with his own inclinations. This inconvenience he endeavoured in some measure to redress by his publick lectures, wherein he chose to dwell more largely upon the respective points, whereon he had touched but slightly in his private instructions. For the truth of this Dr. Van Swieten * appeals to the testimony of such of his hearers, as were present with him at the lectures he gave in publick concerning the *stone*, the *venereal disease*, the *nerves* and *nervous disorders*, and concerning the *heart*. That the reader, however, might be deprived of no advantage, the substance both of these publick lectures, so far as they could be adapted to the explication of the Aphorisms, as also of his private instructions, is inserted by the Doctor in these commentaries. He has farther added,

whatever

* Præfat. ad hunc Commentar.

The P R E F A C E. vii

whatever his own great judgment or experience could suggest to him, as useful upon this occasion, and has also interwoven the several passages, which from time to time he had collected from the most eminent, and more especially the antient, Physicians, for his own private benefit. From this last circumstance the reader will plainly discern, how nearly the reasonings and observations of Dr. Boërhaave have been allied to those sentiments of Hippocrates and Galen, which have already stood the test of so many ages, and will still continue to be approved of, whilst human nature shall itself subsist.

From the usefulness therefore of this undertaking, we hope, that an English edition of it will be received by all, as an acceptable service done to the publick. The practice of Physick, as it now stands in England, is by no means confined to men of learning only: and we judge, that it cannot but be of benefit to mankind in general, that all, who are entrusted with the care of life and health, should be directed to a right way of thinking in the best manner that is possible.



T H E

THE
CONTENTS
OF THE
FIRST VOLUME.

INTRODUCTION,	Page 1
The diseases of a simple solid fibre,	39
The diseases of a weak and lax fibre,	44
The diseases of a stiff and elastick fibre,	85
Diseases of the least and larger vessels,	98
Diseases of weak and lax viscera,	104
The diseases of too strong and rigid viscera,	126
Of the most simple and spontaneous disorders of the humours,	156
Spontaneous diseases from an acid humour,	157
Diseases from a spontaneous gluten,	183
The diseases from a spontaneous alkaline cause,	216
Of the diseases that arise solely from the excess of the circulatory motion,	253
Of the diseases arising from a defect of the circulation, and of a plethora,	285
The most simple of the compound diseases, an obstruction and a wound. An obstruction,	302

COM MENTARIES
UPON THE
APHORISMS
OF
HERMAN BOËRHAAVE,
CONCERNING THE
KNOWLEDGE and CURE of DISEASES.

INTRODUCTION.

SECT. I.

EVERY state of the human body, which is injurious to the vital, natural, or even animal functions, is named a Disease.

We have here given us the perfect definition of a disease, a point necessary to be premised, before any thing certain can be established concerning the cure of diseases. When the body is found to decline from health, all men say it labours under a disease; but as Galen (a) has well observed, we use this word *health* with some degree of latitude, *Non enim absoluta ipsa est, nec indivisibilis simul, quæ est & dicitur sanitas, verum etiam quæ ab hac deficit, modo adhuc usibus nostris non sit inepta*; "Health, whether real or reputed," says

VOL. I. B he,

(a) De sanitate tuenda, Lib. I. cap. 5. Charter. Tom. VI. pag. 45.

he, "is not absolute and indivisible, but we give this name to such a degree of it, as renders a man capable of going about his business."

It would perhaps be a very difficult task to find a man perfectly in health, in whom there was nothing amiss either in the solids, the fluids, or in the motion of the fluids through the solid canals; for we undergo so many alterations every day, from the change of the air which surrounds us, the affections of the mind, the greater tenacity or larger quantity of the food we take down, &c. that we cannot but in a looser signification be said to be in health; and for this reason I apprehend Galen (*b*) has defined health in this sense; *perfecte sanus nemo dici potest, sed sani dicuntur, qui nulla corporis parte dolent, & ad vitæ munera haudquam sunt impediti*; "No person can, properly speaking, be said to be perfectly in health, but we usually say such persons are in health as have no particular complaint, and are able to discharge the common offices of life."

Now health injured is disease. But for the greater regularity of enquiring into diseases, Physicians have reduced the functions of an healthful body into three kinds, which they have named vital, natural, and animal. Those functions are named vital, which are absolutely necessary to life, and without which there is no life. For both solids and fluids may certainly subsist unaltered both in quality and quantity, and yet there may be no life; thus when a man is drowned, the body receives neither diminution nor accession, only motion is wanting, and if this could be restored, life would return.

How just an image of death do we find in a man, who has fallen into a syncope? Throw cold water upon him, and the veins will contract, and drive the blood towards the heart, which being thus irritated will contract likewise, and the man revive.

Perfect

(*b*) De sanitate tuenda, Lib. VI. cap. 5. Charter. Tom. VI. p. 170. & de morb. differentiis, cap. 1. Charter. Tom. VII. p. 1.

Sect. i. INTRODUCTION. 3

Perfect life is health, the abolition of life is death, and life injured is disease.

Since the discovery of the circulation of the blood, it is plain to a demonstration, that the lowest degree of life still requires the contraction and dilatation of the heart; but these cannot subsist, unless there also remains the muscular motion of the heart, the influx of the venal blood into the cavity of the heart, and the expulsion of the arterial blood from the cavity of the heart.

But there can be no muscular motion of the heart, without the free action of the cerebellum and the nerves which are distributed from thence to the heart, and the impulse of the arterial blood through the coronary arteries.

Nor can the venal blood flow into the heart, without the return of the blood into some of the veins at least.

And after a man is once brought into the world, the blood must have a free passage through the lungs, before it can pass from the right ventricle of the heart into the left.

The Ancients made the vital functions two-fold, and called by this the name pulse and respiration; but the vital functions seem to be all those conditions, without which life cannot subsist; and the pulse and respiration are the external signs of life.

For this reason vital diseases are all those, which hinder the influx of the venal blood into the cavities of the heart, and the expulsion of the arterial blood from the cavity of the heart, as appears from a proper enquiry into every different kind of death.

And hence we see the truth of that saying of Hippocrates (c) in the beginning of his book *De locis in homine*; *Principium corporis mihi quidem nullum esse videtur, sed partes omnes peræque principium, omnesque finis. Descripto namque circulo, principium non invenitur*;

B 2

nitur ;

(c) Charter. Tom. VIII. p. 357.

4 INTRODUCTION. Sect. 1.

nitur; "That no part of the body can properly be called the first, but that each particular part is alike the first and the last; as when you have drawn a circle, you cannot tell where it was begun."

To the action of the heart is certainly required the action of the cerebellum upon the heart by the nerves; nor can the cerebellum act, secrete the animal spirits, or carry them so secreted through the nerves, without the action of the heart impelling the blood through the arteries of the cerebellum; and so of all the rest.

And thus the heart acts, so far as it has the causes of its motion common with other muscles; but there is this wonderful property in the heart, that, independent of these, it is capable of continuing its motion for a considerable time.

For which reason the Antients supposed there was a latent vital principle residing in the heart; and Galen has said, that motion was innate to it.

Nor will this seem absurd to any person who considers, that though the heart be furnished with the common causes of muscular motion derived from the arteries and nerves, it farther contains within itself a power of raising motions, which cannot be deduced from the structure of the parts, that we are hitherto acquainted with.

For cut off all the vessels from the heart, and the heart will continue its motion, and for a considerable time too; thus the heart of an eel taken out from the body continued to beat, and though put under a receiver, and the air exhausted, its (*d*) pulsation did not cease for the space of an hour; the heart of a flounder, cut transversely into two parts, (*e*) retained its motion for a great length of time, though the blood had been squeezed out of it by pressure, and both sides of it wiped with a cloth.

From

(*d*) Boyle's new Exper. concerning Respiration, p. 18. (*e*) Boyle of the usefulness of Experimental Philosophy, Exerc. 1. p. 112.

Sect. I. INTRODUCTION. 5

From such experiments as these it was, that (f) Galen concluded, the heart did not want nerves for the discharge of its proper function, &c. that it was a mistake, to think that the heart was a muscle, &c. and that it was in a manner the fountain of native heat.

Many other experiments of the same nature might be brought concerning the hearts of animals; but that the observation holds good in the heart of a man appears from the words of Lord Verulam (g), who says that *upon the embowelling of a criminal, (which is a kind of punishment used in England for high treason) he had seen the heart of a man, after it was thrown into the fire, leap up for several times together, at first to the height of a foot and a half, and then gradually lower, to the best of his memory, for the space of seven or eight minutes.*

The natural functions are all those, which are instrumental in repairing the several losses, which the body sustains, and making good the several deficiencies both in quantity and quality. For life is destructive of itself, the very functions of life occasion a perpetual waste, and were we not to receive fresh supplies from the food we take down, we should soon cease to be. And Galen has justly (h) observed; *quod à singulis partibus defluit, tale est, qualis ipsa pars. Nihil autem eorum quæ edimus aut bibimus, tale prorsus est; hinc necesse habuit natura prius immutare.* (μεταβαλλειν) *Et concoquere illas Et alendo corpori similia prorsus præparare* (προπαρασκευαζειν); “that what is carried off from each particular part is of a resembling nature with the part itself; and yet what we eat or drink bears no such similitude; for which it was necessary, that nature should first concoct our food, and change it by a proper preparation into a like substance with the parts that are to be nourished.”

B 3

The

(f) De anatom. administrat. Lib. VII. cap. 8. Charter. Tom. VI. p. 155. (g) Hist. of life and death, p. 559. (h) Comment. II. in lib. de alimento Hippocratis, Charter. Tom. VI. p. 245.

The food therefore we take down is not alone sufficient for this purpose, there is farther required a most perfect machine of a created body, to turn it into nourishment.

Hippocrates, who usually expresses a great deal in a few words, says, *(i)* *alit concoctum*; "food concocted nourishes."

And for this reason he *(k)* observed in his Aphorisms, *à morbo bene comedenti nihil proficere corpus malum*, "that a diseased person receives no benefit from "taking down a large quantity of food, whilst he is "sick;" meaning, that the concocting powers were wanting, or, which is the same thing, that nature was itself deficient.

Now what are we to understand by nature, *(φύσις)* the old word used by Hippocrates, which has by many been so ill explained? Why nothing else, but the aggregate of all the physical conditions, which are required to that most constant, durable, and at the same time active power of moving, wherein life consists; now this is perfect health; if there be any thing wanting thereto, nature is deficient, and the defect is a disease.

Physicians therefore do no injury to the Supreme Being, when they ascribe so much to nature; as they hereby understand the constitutional frame of the created body.

It was therefore well said by Helmont *(l)*, *Naturam esse jussu Dei, qua res est id quod est, & agit quod agere jussa est*; "that nature was the order of God, "by which a thing is what it is, and acts what God "has ordered it to act."

Upon the same subject Hippocrates, *(m)* *Natura omnia omnibus sufficit*; "nature supplies all things to "all;" *(n)* *(νέσων φύσις ἰατροί) morborum naturæ medicæ*;

(i) De alimento, Charter. Tom. VI. p. 245. *(k)* 31. Sect. II. Charter. Tom. IX. p. 37. *(l)* Pag. 38. *(m)* Sexto Epidem. Charter. Tom. IX. p. 509, & 513. *(n)* De alimento, Charter. Tom. IX. p. 264.

cæ; & invenit natura sibi ipsi vias, non ex intellectu
(ἐκ ἐκ διανοίας); à nullo edocta natura, & citra dis-
ciplinam omnia, quæ conveniunt, efficit; “ diseases are
 “ cured by nature; and nature has found out ways
 “ of itself without art or contrivance; nature untaught
 “ does all things necessary of itself without instruc-
 “ tion;” to which passage of Hippocrates (o) Galen
 seems to have alluded, when he writes, (*φύσις γὰρ ζῴων*
ἀδιδάκτοι) *naturæ enim animalium à nullo doctæ sunt, dicit*
Hippocrates; “ that according to Hippocrates, the na-
 “ tures of animals are untaught.” And this he con-
 firms by divers examples, for instance, the calf butts
 with its forehead before its horns are grown, and the
 colt kicks whilst its hoof is yet tender, &c.

The manducation therefore of our food, the deglu-
 tition of it, and digestion in the stomach and inte-
 stines, the separation and distribution of the chyle,
 the secretion of the excrements, &c. are brought un-
 der the head of natural functions, as by these our
 meat and drink are converted into our nature.

The name of Animal is given to all the changes
 wrought in the body of a living man, which occasion
 a change in the thoughts of the mind, or are produ-
 ced by a thinking mind.

These functions therefore all of them suppose
 thought.

That which thinks is called the mind; for the first
 thing that we know of the mind is that it thinks. Is
 this thinking then the mind itself? It is, sure; that
 though all things were to remain in the state they are,
 they would be nothing with respect to us, if we did
 not think, and this is all we know of the mind.

Some of these functions are discharged, when new
 thoughts arise in the mind, either from an external or
 internal cause, by a preceding change in the bodily
 organs though almost entirely superficial; thus the
 mind discerns real objects, if the eye be good; but

B 4

sick

(o) De usu partium, Lib. I. cap. 3. Charter. Tom. IV. p. 286.

8 INTRODUCTION. Sect. 1.

sick people often imagine they have objects before them which are not present, from a change in the bodily organ merely by internal causes, and not occasioned by external objects.

Other animal functions are discharged, when the mind, from a change in its own thoughts, works a change in the body, by raising some muscular motion: *v. g.* a man wills to lift up his arm, and it is straightway lift up; for it is a property inherent in man, that as his will directs, he shall be able to excite motion, continue, direct, change, stop, or renew it.

It is strange indeed, that as these motions thus excited by the will are in themselves so evident, and mechanically produce such notable changes in other bodies, they should yet scarce seem to be originally corporeal, or have any apparent cause; I mean, that there should be seen no physical change in the body, exclusive of the action wrought, nor any footsteps of the alteration, when the will has put a stop to the motion.

These actions are farther all of them wrought without any knowledge of the cause; for the most skilful anatomist can perform them no better than an idiot; which is sure a matter of the deepest speculation.

All other animal actions are usually supposed to belong to what are named the internal senses; *i. e.* the memory, the imagination, the affections of the mind, attention, &c.

For the mind is capable of thinking without any aid from the external senses by virtue of its own powers, and meditating as it were apart by itself.

Thus we often remember, that we had once an idea, which we cannot now recollect. The thinking principle then searches for this idea in its own storehouse within; and though it knows not exactly what it seeks for, it yet distinguishes it from all other things which then offer themselves to its thoughts.

Yet

Yet even these inmost thoughts are capable of being changed, and even quite effaced by a change in the body. For how often have we seen in cases of melancholy the imagination of the wisest men depraved, and the memory destroyed, &c.

And though Hippocrates said (*p*), *qui aliqua parte corporis dolentes ut plurimum dolorem non sentiunt, illis mens laborat* (ἡ νόσος τοῦ νοῦ); "that diseased persons, who were not sensible of their indisposition, laboured under a distempered mind;" yet in this case he applies remedies, not to the mind, but to the body. For when he was setting out for Abdera, at the request of the inhabitants, to cure Democritus, whom they apprehended to be mad, he gave directions to Cratevas to collect the herbs he judged proper for the cure (*q*).

It is upon the body that medicine almost constantly acts, even in those diseases where there is no apparent change in the body, but merely a change of the thought. Thus in one species of madness, for instance, the most sagacious Physicians can discover nothing amiss in the corporeal system, and yet the man raves outrageously without a fever. In these cases, however, they have constantly applied such remedies, as by their prodigious force might be able so to rouse the whole system of nerves, vessels, and muscles, as to leave no part remaining in the same state wherein it was before; with this view, that by thus shaking the whole frame, the latent impression on the sensorium commune, from whence the disease arose, might be erased.

Thus Melampus of old, who lived long before the Trojan war, upon observing the madness of goats to be carried off by hellebore, by the same means successfully cured the king's daughters of this disease; from whence Hippocrates also has named hellebore *Melampodium*.

(*p*) Aphor. 6. Sect. 2. Charter. Tom. IX. p. 47.

(*q*) If Hippocrates be the author of those epistles, which are commonly ascribed to him.

S E C T. II.

THAT part of the science of physick, which teaches how to find out and cure the disease that afflicts the patient, is called the practice of physick.

The chief end of all knowledge in the art of physick is to restore health to the sick. And hence Celsus has justly observed, *(a) ut alimenta sanis corporibus agricultura, sic sanitatem ægris medicina promittit*; “ that
 “ as healthful persons have reason to expect a supply
 “ of food from agriculture, so have the diseased cause
 “ to hope for the recovery of their health from the
 “ use of medicine.” Practice therefore, so called ἀπὸ τῆς πρᾶξης, is that part of the science of physick, which teaches how to find out by undoubted natural signs in the patient, when there is a disease, what that disease is, in what state, whether in its beginning, increase, height, or declension, and by what method and means this disease, now found out, may be carried off.

All these considerations are farther to be applied to the case of the sick person that is visited. For it is quite a different thing to describe a pleurisy, and to point out by the rules of art, that the sick person you visit labours under this disease, especially as in its different stages it requires a different treatment, though it is always called by the same common name.

Such Physicians as now practise this art, were formerly called Clinics by the Antients, from visiting sick persons as they lay (ἐν κλίναις) in their beds.

S E C T. III.

WHoever therefore is unacquainted with what is requisite to the just discharge of

(a) Pag. 1. in ipso initio præfationis.

Sect. 3. INTRODUCTION. 11

of the vital, natural, and animal functions, and of course is ignorant of the causes of life and health, can never rightly discern their defects, *i. e.* diseases.

A Physician therefore must know what the disease is, before he can cure it; for a disease (as we have observed) is the disorder of some function requisite to health. How then shall he know what is amiss in this function, who is not acquainted with all that is required to the due discharge of it? It is a just observation in Galen (*a*), *cujusque morbi tanta magnitudo est, quantum à naturali statu recedit, quantum verò recedat, is solus novit, qui naturalem habitum ad amissum tenuerit*; “the degree of a disease must be computed by the degree of its departure from a natural state, and what this is he can only know, who is thoroughly acquainted with the natural state.”

Blindness, for example, is the name of a disease signifying the loss of sight. This disease may take its rise either from a concretion of the eye-lids, the obscuration of the cornea, after violent inflammations, or scars left in it, &c. the aqueous humour grown turbid, or the crystalline humour opaque, may take away sight; the optic nerve expanded on the retina may become senseless; the same nerve too may be compressed by various tumours, an exostosis, &c. in any part of its course from the ventricles of the brain to the eye; or the origin of the misfortune may lie in the ventricles of the brain themselves.

Now he who is unacquainted with the fabrick of the organ, and consequently unable to distinguish among so many possible causes which is the real one, from whence the present disorder proceeds, how shall he be able to apply the proper remedies?

In the case of blindness following upon a burning fever, where the stagnating blood was scarce able to
move

(a) De methodo med. ad Glaucon, Lib. I. cap. 1. Charter. Tom. X. p. 345.

move through the distended arteries, in vain were collyria applied to the eyes, which were still clear and bright; a Physician of judgment placed all his hope in a large and salutary discharge of blood from the nostrils; by which means the vessels being emptied, and the inflammatory size attenuated, the sight was perfectly restored.

To this may be objected the skill of Hippocrates in this art, which has gained the approbation of so many ages, who, without all those beautiful discoveries which the present age enjoys, made such great advantages in the art of healing, solely by his observation of the appearances in diseases themselves.

But certainly Hippocrates, great as he was, would have still been greater, had he been acquainted with the discoveries of the Moderns.

Whence then is it, that after so many new discoveries, the art of physic still falls short so much of certainty? The reason seems to be this:

The industry of the Moderns has indeed made many discoveries concerning the structure of the body, though more still lie concealed, and perhaps will do so long. Physicians growing vain upon these improvements, and being too much inclined to form hypotheses, from a few observations, have laid down general rules for practice. And if any thing occurred in diseases which did not well agree with their preconceived hypothesis, they either entirely neglected it, or tortured it by force into a seeming agreement.

Thus would they make the art short, which the wisdom of antiquity pronounced long.

This itch of forming general rules, and reducing the art to a few axioms, has long prevailed. The Methodists of old thought it sufficient (*b*) *quædam communia morborum intueri*, “to consider some of the “common properties of diseases;” and these they divided into three kinds, whereof one was supposed to arise from too great a retention, another from too large

(*b*) Celsus in præfatione, L. I. p. 5.

Sect. 4. INTRODUCTION. 13

large a discharge, and a third from an intermixture of both these.

They therefore who to the correct observations of the Antients join the discoveries of the Moderns, seem to lay the best foundations for raising a just superstructure.

S E C T. IV.

A Cure therefore is the changing of a disease (1) into health (2). This therefore supposes also the knowledge of what we have already mentioned (3); and consequently the knowledge and cure of diseases require the knowledge of those principles, which explain what life and health is; *i. e.* an acquaintance with the theory of physic.

The first part of the practice of physic takes in the discovery of diseases; the other teaches how a disease when found out may be cured.

But to this cure is required the like knowledge of all that we have mentioned above; for a cure is such a change of the body, as removes the state which was termed a disease, and restores the state, whereof the privation occasioned the disease. An example will make the matter plain.

That kind of paronychia, in which with scarce any swelling a most acute pain seizes the last joint of the fingers, attended even in otherwise the most healthful persons with a violent fever, syncope, phrenzy, convulsion, and oftentimes death before the third day, owes all its malignity to the peculiar structure of the part: for the tendons which bend the two last joints of the fingers are covered by a strong ligament, almost as hard as a cartilage, described formerly by Galen (a).

Now

(a) Galen. admin. anatom. Lib. I. cap. 5. Charter. Tom. IV. p. 36.

Now if an inflammation be formed under this stiff shield, (whether it be from the ligament itself, the membrana cellulosa, the periosteum, or tendons, it matters not) all these terrible symptoms follow, because the part inflamed lies under this hard covering, which cannot give way. A Physician called in time, who is acquainted with the structure of the part, boldly orders all the integuments to be cut through with a lancet on the side of the finger down to the bone. By this means changing the singular structure of the part into a like state with that of the rest of the body, the pain is straightway asswaged, and this threatening disorder easily yields to the application of emollient medicines.

The truth of this proposition might be demonstrated by more examples, but this one is sufficient.

S E C T. V.

THAT change either (4) occasions, stops; or directs a certain motion, by the application of such instruments, as the artist ought to know and direct; and thus we suppose him acquainted with all that relates to diet, medicines, and surgery, the manner how they are to be prepared, and the method of applying them.

There can be no cure, unless there be still left some degree of life and of motion in the vital humours through the vessels. It is this motion which gives activity to the remedies applied, for on a dead body they would produce no effect. We increase this motion when too languid, as in many chronical diseases; or with prudence allay it, when it would destroy the body by its violence, as in very acute ones; or when it rushes on some particular part with too much force, we divert it to another by revulsion.

Sect. 5. INTRODUCTION. 15

When the body languishes under a load of pituitous matter, we rouse by acrid stimulatives. If a man be raving in an acute phrenzy, we weaken by bleeding, and avert the violence from the head, all we can, by bathings, fomentations, scarifications, and the like.

But these are all performed by certain instruments, which, applied to the diseased body, so change it as to produce health; these instruments are called medicines.

Concerning these Hippocrates says (*a*), *omnia medicamenta sunt, quæ præsentem statum (τὸ παρὸν) dimovent, vebementiora autem omnia immutant, &c. ægrotanti verò omnia è præsentī statu dimovere conducit*; “that all medicines alter the present state of the patient, but such as are most efficacious make a thorough change in the whole frame, &c. which in a diseased person is a necessary circumstance towards a cure.”

These instruments are applied to the human body by diet, medicine and chirurgery.

In the first ages of physic the care of all these belonged to the same Physician.

But about the time of Herophilus and Erasistratus, physic was divided into three branches; whereof one cured by diet, another by medicines, and the third by manual operation (*b*).

It would be a reproach to an artist not to know the instruments of his own profession; and supposing a Physician to have clearly discovered what ought to be changed in the body to produce health; yet if he knows not by what means to effect the change, he will do no service.

Nor is it enough to have cursorily learned the names of his medicines, for without a perfect knowledge of their nature and properties, he would soon expose himself by the improper form of his prescriptions, and frequently do his patient a prejudice.

for

(*a*) De locis in homine, cap. 16. Charter. Tom. p. 375.

(*b*) Cels. præfat. p. 3.

For how is the nature of medicines changed by their various preparations! the Syrian scammony given pure, dissolves the humours into a putrid water, and then carries them off by stool; yet the same medicine, by being exposed to the vapour of burning sulphur, as in making the *diagridium sulphuratum*, is rendered almost inactive.

The root of rhubarb infused in hot water forms an innocent purge for every age and sex; but by long boiling loses both its fragancy and virtue.

A Physician ought also to be acquainted with the different methods of using drugs. Resin of jalap given alone, and by its tenacity adhering to the folds of the stomach and intestines, has frequently brought on an *hypercatbarfis*; but if this quality be corrected by pounding it with a little sugar, or the yolk of an egg, it may then be used with far more safety.

Hippocrates used to drop the very acrid juice of tithymal into figs, that it might not injure the throat in its passage (c).

Innumerable other examples of the same nature might be brought to show, how necessary the knowledge of the *Materia Medica* is to a Physician,

S E C T. VI.

THE application of these means is directed by a foreknowledge of their effects, which requires a general knowledge of the laws, according to which those actions are performed; which shews the doctrine of the signs, and of the method of healing, to be a necessary science. So that whoever designs to lay down rules for the practice of physic, ought first to be well acquainted with every branch of the theory of physic. This therefore we shall now suppose, not only

(c) De victu acut. Charter. Tom. XI. pag. 183.

only known, but also demonstrated in another place.

But the difficulty here lies in being able so to direct these instruments, as to effect the change which art requires to the restoration of health.

For the application of all medicines is made to a living body; they are brought into action by life, and frequently produce different, and sometimes opposite effects, in different subjects, from a particularity of constitution; nor can this be ever determined beforehand, but is only to be learnt from experience.

The same medicine shall produce a different effect in sickness and in health. The bile exalted by violent summer-heats, if irritated by some gentle purge, shall frequently bring on an enormous quantity of stools; while six times the dose given to a man in a dropy shall not occasion a single motion. Five grains of *mercurius vitæ*, given to a woman in a maniacal case wrought no effect; though before she was afflicted with this disease, a few grains of scammony threw her into fainting fits, through the violence of its operation.

In chronical diseases, where the viscera are almost tabid and ready to fall to pieces, how dangerous is it to give even the mildest vomit of *Ipecacuanha*.

These are points, which require the attention of a prudent Physician; for when a medicine is once administered, the effect is no longer in his power.

It was Galen's observation (*a*), *sive purgans dederis, sive vomitorium, &c. primo exhibitio in tua potestate est, reliqua sibi fortuna vindicat*; "whether you give a purge or a vomit, &c. the administration is in your own power, but the consequence must be left to fortune."

Besides, in diseases nature so often endeavours by unknown ways to expel the latent morbid matter,

VOL. I.

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whether

(*a*) Galen de venæ sectione, adversus Erasistratum, cap. 7. Tom. X. p. 401.

whether it be the cause of the disease or its effect, that he who shall imprudently disturb her in these good beginnings by opposite remedies, must always do mischief.

And hence the doctrine of signs, and the method of healing, are sciences absolutely necessary; and for the same reason it is, that Hippocrates is so very minute in the enumeration of signs.

So that upon the whole we may conclude that every branch of the theory of physic is necessary to be known by him, who would attempt to learn the practice.

Galen made the same conclusion when he says, (*b*) *at non propter se cætera omnia ad artem spectantia aut discimus, aut docemus, aut denique auscultamus, sed quod eorum unumquodque sit ad finem utile;* “all other particulars relating to the art we neither learn, nor teach, nor even give ear to upon their own account, but merely as each of them is subservient to the end we aim at.”

S E C T. VII.

A Disease, as it is seated in the body, must be the bodily effect of some particular cause, directed to that body.

From what we have before observed on Sect. I. it is plain that Physicians in all ages have applied medicines to the *body*, even in those diseases where the functions of the *mind* only seemed to be disordered. Nobody every doubted whether the disease and its cause were both inherent in the body, when they perceived a sensible change in the body, but many have fancied it a paradox to form the same judgment of those diseases, wherein the *thought* only appears to have been affected.

But

(*b*) Comment. in Hippoc. de officina medici. Charter. Tom. XII. p. 3.

Sect. 8. INTRODUCTION. 19

But the thinking principle within us seems to be immutable, simple, always and every where the same: for let me think of what I will, I know it is I who think; I know of what I think; and though I think of different things every moment, there must remain in me who think, something which is always the same amidst the infinite variety of objects that affect my thoughts.

This thinking principle, according to the direction of the adorable Creator, is so united to the body, as that a change in the body should make a change in the thoughts: and, on the other hand, a change in the thought can make a change in the body. All therefore that lies in the power of medicine is, by changing the body to amend the injured action of the mind that is united to it: for it is often a very slight disorder in the body which oversets the whole mind. Thus ideots are almost always observed to have the shape of their heads depraved from the birth. So a single ounce of blood extravasated under the skull effaces all our humanity. A boy (*b*) of eight years old during a hot season used to lose the memory of all that he had learned, but two or three days cooler weather would restore it again, and with the hot weather the same calamity returned.

Innumerable other instances confirm this matter.

A Physician therefore considers diseases as consisting in a change in the body.

S E C T. VIII.

THE entire removal of which is the cure.

When a Physician therefore by a careful examination has found what it is in the functions that deviates from health, and by what cause that change in the body is wrought which is named a disease, he then labours by all the known assistances of art, to take this

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cause

(*b*) Histoire de l'Academie de sciences, 1705. p. 73.

cause away. For the axiom is allowed to hold universally, *take away the cause, and the effect will cease.*

It is to be carefully observed here, that it is very possible the cause of a disease may be removed, and of course the disease itself, and yet several of the functions may be left depraved by the preceding disease. A man labours, for example, so long under a severe autumnal quartan ague, till by the repetition of the fits the solids are so weakened, and the fluids so dissolved, that a dropsy ensues. Give him the Peruvian bark, the fever is cured, but the dropsy remains. This however will warrant no such conclusion, as that by taking away the cause of the disease you have not taken away the effect; for the Peruvian bark has so subdued the cause of the fever, that its effect, the fever, is gone; but the fever has so changed the body as to make it dropical: and though the fever be removed by the bark, yet those causes remain from whence the dropsy followed as an effect, namely, the too great weakness of the solids and dissolution of the fluids.

S E C T. IX.

THIS removal is obtained, by correcting that particular illness, either by the application of a remedy to the part particularly diseased, or by remedies operating actually upon the whole. The latter we shall call a general, the former a particular one.

We have a twofold method of removing diseases, either by acting directly on the diseases themselves, without changing the rest of the body, or by changing the whole body to destroy and expel the disease.

A quartan, which had been treated in vain with purges, vomits, sweats, and which even kept its course in the midst of a salivation (as I myself have seen), was cured by the Cortex Peruvianus, without producing any other visible change in the body. This therefore

Sect. 10. INTRODUCTION. 21

fore we call a peculiar or specific remedy, as in carrying off the fever it works no other change in the body. Opium swallowed down and lying in the stomach removes all sense of pain, without disturbing the body. And possibly there may be in nature resembling remedies for other diseases, which Physicians would be happy if they could but find out.

A stone falls from the kidney into the pelvis, and thence into the ureter; and thence arises intolerable pain with convulsions of the lower belly, nausea, vomitings, &c. if the Physician now knew a remedy by which to dissolve the stone that is lodged there, this would be a present cure; but for want of this he is forced to change the whole body by fomentations, clysters, bleeding, and the most emollient decoctions, that he may expel the enemy through the now relaxed and lubricated passages; and this is called a general cure.

This method generally acts by introducing another disease. For when the Physician cures the lues venerea by salivation, the patient is laid up for a month at least before he can be freed from this terrible disease.

Herein we imitate the salutary proceeding of nature, which often expels the cause of a disease by a commotion of the whole body.

If a little bread falls through the mouth of the larynx, nature by her faithful guards, the nerves, excites a most violent fit of coughing, nor suffers it to rest till the bread is thrown out.

And hence Sydenham boldly concludes, that *a disease, how adverse soever its cause may be to the human body, is nothing else but nature's endeavour with all her might to expel the morbid matter, for the good of the patient (a).*

S E C T. X.

BOTH are discovered, either by observation, by comparing one case with another, or by reasoning from these together.

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(a) Pag. 39.

There is no doubt, but both medicines, and the practice of physic, were discovered by single observations; for the first advances in physic seem to have taken rise from mens advising others in sickness, to make use of remedies which they had found beneficial to themselves or others, in hope they might prove successful to them in like manner.

And when they saw others labouring under a disease not entirely the same, but yet bearing some resemblance to one they had observed before, they concluded from this likeness that they required a resembling method of cure.

The sect of the Empirics contended that the whole medicinal art rested on these two methods only: for they said, *(a)* *diligentes homines hæc notasse, quæ plerumque melius responderent, dein ægrotantibus ea præcipere coepisse; sic medicinam ortam, subinde aliorum salute, aliorum interitu, perniciofa discernentem à salutaribus;* “that persons of diligence had marked down the remedies, which in general had best answered, and thence took occasion to prescribe them to the sick; and that thus, from the recovery of some, and the death of others, the practice of physic had its rise, as it distinguished the applications which were hurtful from such as were attended with benefit.”

If an unknown disease occurred, *(b)* *medicum protinus visurum, cui morbo id proximum sit, tentaturumque remedia similia illis, quæ vicino malo sæpe succurrerint, & per ejus similitudinem opem reperturum, &c. latentium vero rerum conjecturas ad rem non pertinere, quia non interfit, quid morbum faciat, sed quid tollat;* “the Physician was then to consider, what disease it resembled, and by applying such remedies as he had often experienced to succeed in a like case, he might be able from the resemblance to administer relief in this, &c. but that conjectures concerning the latent causes of diseases were of no consequence, as it mat-
ters

(a) Celsus præfat. Lib. 1. pag. 9. *(b)* Celsus ibid. pag. 10.

Sect. II. INTRODUCTION. 23

“ters not what it is that causes a disease, but what
“can remove it.”

By reasoning correctly from these two, many useful deductions may certainly be made, provided that nothing be admitted as an observation that is uncertain, nor any conclusion drawn from thence that is contrary to experience. For it is certainly just advice, with which Celsus concludes his examination of the disputes which passed between the Empyrical and Rational sect of Physicians (*c*), *rationalem quidem medicinam esse debere: instrui vero ab evidentibus causis; obscuris omnibus, non à cogitatione artificis, sed ab arte ipsa rejeclis*; “that the practice of physic ought indeed to be
“grounded on reason, but that evident causes only
“ought to be admitted, all such as were obscure being not only to be rejected from the consideration
“of a Physician, but from the art itself.”

S E C T. XI.

Observation is taken; 1. From an accurate history of the disease, giving an account of its causes, nature, and effects; 2. From an exact enumeration of all such things, as have proved beneficial or hurtful, whether given to the patient by accident or design; 3. From the inspection of opened bodies, whose diseases had been well observed before their death.

1. When a man is first taken ill, there is a change wrought in him from a state of health, otherwise there would be no disease. This departure from health we may discover by our senses. As the disease proceeds, he declines still more from a healthful state, new changes daily appear, and those which were taken notice of before do either increase, remain the same, or diminish, and even sometimes quite disappear; these par-

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ticulars

(*c*) Ibid. p. 20.

ticulars carefully observed in the order they **follow** one another give the history of the disease. But now a disease, as an adequate effect, is the same with its compleat or proximate cause, the presence of which supposes its disease, and the absence its removal. This proximate cause is seldom simple, but generally compounded of other causes, which singly would not be sufficient to produce the disease, as they do when united. *v. g.* The proximate cause of a pleurisy is an inflamed sily blood, driven into vessels too strait for it to pass through, and having its motion farther increased by a fever. No one of these three causes alone makes a pleurisy, but all uniting constitute the disease. These causes now which jointly make up the proximate cause, are either the pre-disposing causes (*προηγμένα*) or (*προκαταρχται*) the occasional.

For instance, a plethoric person, after violent muscular motion in a very hot season, by the rupture of an artery in the cerebrum, falls into an apoplexy. The remote pre-disposing cause in this case was the plethora, the occasional causes the heat of the air and the increased impetus of the blood by muscular motion; but neither the heat of the air, nor the muscular motion, would have brought on the apoplexy, if the man had not been plethoric.

This was well observed by Galen, where he says (*a*), *corpore nostro ad morbos quasi præparato, externum quoddam adveniens febrim accendit, quod ex se morbum vehementem minime generaret, &c. et propter corporis dispositionem unumquodque horum non morbi causa sed occasio redditur; has causas vocaverunt προαΐσεις*; “ that the
“ body being in a manner prepared for the reception
“ of a disease, the intervention of an external cause
“ shall raise a fever, which of itself would have been
“ insufficient to have produced any distemper of consequence, &c. but through the disposition of the
“ body becomes rather the occasion, than properly
“ speak-

(*a*) Comment. 4. in Hippocrat. de victu acut. Charter. Tom. XI. pag. 178.

“ speaking the cause of the distemper. This sort of
 “ external causes have been termed *πρῶτα σείς*.”

Celsus writes much to the same purpose (b), *nihil omnino ob unam causam fit, sed id pro causâ apprehenditur, quod contulisse plurimum videtur; potest autem id, dum solum est, non movere, quod junctum aliis maxime movet*; “ no disease is absolutely owing to a single
 “ cause, but that is judged to be the cause, which
 “ apparently most contributes to produce it; for
 “ that, which singly can produce no visible effect,
 “ oft proves extremely efficacious in conjunction
 “ with other causes.”

He now that by accurate observation hath thus discovered the proximate cause of a disease, understands the nature of it.

The disease, however thus understood in its causes, in the progress of it is changing the state of the body every moment, and doing still farther mischief to the functions, and thus produces as it were new diseases, which are called effects of the disease, or symptoms: for under this name are comprehended all those preternatural appearances, which are seen in the patient from the disease as a cause, yet so as that they may be distinguished from the disease and its proximate cause.

For instance, a man in a pleurisy, through the sharpness of his pain, dares not dilate his breast in order to draw in his breath; by this means the blood passing with difficulty from the right ventricle of the heart, through the lungs, begins to be accumulated there, and forms a peripneumony. This now is a new disease, but springing from the pleurisy as its cause.

2. In all diseases life still subsists, and life is always in action; the sick man therefore either is in motion and does something, or is at rest and does nothing, he either eats and drinks, or he does not; and these are followed with certain effects good or evil. Now the Physician observes all that passes during the disease, what does good and what does harm, and then forbids the

(b) In præfat. Lib. I. pag. 16.

the one and prescribes the other; this is the doctrine of things useful and hurtful, which is of so great account in practice, and which gave the first rise to the art of physic. See Celsus (c).

By accident.] In the various trials made sometimes by the sick, unforeseen and remarkable changes are frequently brought about, which administer occasion for very beautiful discoveries in the art. Thus Galen says he has often seen (d), *non paucos febre ardente laborantes, cum jam mediocriter concocti humores essent, statim ex frigida potione liberatos*; “several persons “in violent fevers cured by drinking cold water, “when the humours were pretty well concocted.”

An epilepsy was cured by spontaneous ulcers on the head, whence Tulpius concluded (e), that artificial ones also might be of service. I have seen a man extremely delirious in an acute continual fever, presently brought to his senses again, upon hearing that his neighbour’s house was on fire.

Or design.] For though a Physician should have done every thing according to the rules of art, yet he ought carefully to attend the event, and observe whether it does good or not. Hippocrates lays down some certain signs, whereby to judge, whether a purging medicine that has been taken shall have done service or no (f), *si*, says he, *qualia purgari decet, purgentur, tum confert, tum facile ferunt, si è contra, difficulter*; “if the humours be avoided, which ought to be carried off, the patient will be relieved, and easily bear “the discharge; but if not, the contrary effect will “follow.” For reason directs us to abstain from what we see does harm. But to arrive at any certainty in judging of things useful and hurtful, it is requisite that we attend with the utmost circumspection to the nature of the disease, else that will very often be attributed to the medicines given, which was owing to the

(c) In præfat. p. 9. (d) Galen. Meth. Med. Lib. IX. cap. 16. Charter. Tom. X. pag. 220, 221. (e) Obser. Med. obs. 8. (f) Aphor. 28. Sect. 1.

the disease only. Thus in a semitertian there is an exacerbation of the fit every other day by the nature of the disease; in this case it would be very wrong to ascribe the symptom of the fits at this particular time to the medicines administered.

3. I wish we had more frequent opportunities of looking into dead bodies: How cautious would Physicians then be in the treatment of diseases, when they knew that they were obliged to shew in the body of the diseased, whether they had judged rightly before of the nature of the disease, and how many of the latent causes of the distempers would then be laid open (g)! Herophilus and Erasistratus dissected criminals alive, and thought it no cruelty to expose a few guilty men to torment, in order to find out remedies for the innocent, in all future ages; and yet many at this day exclaim against opening the bodies of the deceased, as a shameful and cruel practice, though it be to render medicine more certainly beneficial to the living. Yet even here the utmost caution is necessary: for the dead body only shews us what its state was at the time of death, and a great many changes will be found made in it by the disease, which however they may be effects of the disease, would be very improperly reckoned to be the cause of it. So when a pleurisy ends in a suppuration, and a Physician inspecting the dead body finds a large quantity of purulent matter collected in the cavity of the thorax, it would be very wrong to conclude that this purulent matter was the original cause of the disease.

The careful inspection of bodies after death has certainly afforded a great number of discoveries, which Physicians otherwise would not have so much as dreamed of. Who would have believed that the œsophagus could have been burst by a violent fit of vomiting; that the spleen growing to an immense size could have fallen down into the pelvis by an elongation of its connected vessels; or that stones could have grown
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(g) Celsus præfat. Lib. I. pag. 7.

in the very substance of the heart that is always in motion.

Bonetus, by collecting in his *Sepulchretum Anatomicum*, and disposing in proper order the appearances found upon dissections, has given great insight into the discovery of the latent causes of diseases.

S E C T. XII.

HE concludes from analogy or similitude who by comparing the present case, as yet unknown, with what hath been already observed and is therefore known, draws conclusions from thence concerning the nature and cure of the present disease, arguing from what is past to what is to come.

This matter will be cleared up by an example. A Physician hath observed one of his patients to have laboured under an acute continued fever, attended with a pricking pain of the side, so as to interrupt his inspiration; and the disease not being relieved either by spitting, bleeding, or any other remedy, a difficulty of breathing comes on and gradually increases, and after long languishing ends in death. After this, inspecting the dead body he finds a large bag full of purulent matter, which by compressing the lungs had produced a suffocation. He then finds in another person the same appearances, which he had observed in the former in the beginning of the disease, and concludes from their likeness that the same event is to be feared: he gives to this what he had found beneficial to the former, and labours with all the powers of art to prevent the same bad consequence: this is called, concluding from likeness or analogy.

Sydenham's method, when he would trace out the hidden nature of any new epidemical disease, was carefully to observe the manner in which it changed to health,

health, death, or another disease ; what efforts nature exerted when able of herself to cure ; and after that imitating these in like cases he concluded by analogy.

S E C T. XIII.

LAstly, he that exactly weighs every individual thing which by observation is found to happen to the patient (11), and then compares each with all the other, and farther considers them in an opposite view to such things as happen in a state of health, and lastly by the use of his reason rises to the knowledge of the proximate cause of the disease, and of the remedies proper to remove it, this man truly deserves to be named a Physician.

What will be the idea of the best Physician in future times we know not ; but he is to be reckoned a good Physician now, who makes use of all the assistances by which, through the happiness of the present age, the art of Physic has been improved.

Geometry shews us, that infinite truths may be discovered in the most simple subjects by long examination, which were not thought of before. What is more simple than the idea of a circle, which every one easily conceives ? yet by applying a right Line to it, what beautiful theorems have thence been deduced !

In like manner in the consideration of diseases ; the discoveries that observation has made are the data, from which when examined with attention and judgment, the ingenious Physician infers numberless and most useful truths.

But each of these is to be diligently considered apart by itself, and not slightly passed over : For instance, when in the beginning of an exact quartan, there comes on that surprizing coldness, ascending from the lowest degree (to sense like that of cool air) to such an
extreme

extreme rigor, as to make the limbs all stiff and inflexible, and frequently to take away all sense, so that the person affected should burn his legs to the bone without feeling it; with what variety of knowledge does this furnish the Physician? For it is demonstrated in physics that cold is the absence of fire, or its not being determined to a particular place; and from the known laws of the human body it is now certainly known, that coldness is the effect of a diminished circulation; so in the beginning of a quartan, we evidently find that the circulation is diminished; the heart indeed beats more swiftly, but not being able to overcome the increased resistance, it cannot propel the vital blood to the extremities; these extreme parts therefore first grow pale, the tip of the nose becomes very pale, the nails and extremities of the fingers, and so the lips. And as the cold contracts all the parts, the veins also being constricted propel their humours towards the right ventricle of the heart with the greater force; the left ventricle of the heart in the mean time is not able to throw out the whole quantity of blood contained in its cavity into the contracted arteries; by which means the blood is accumulated about the heart and lungs, and occasions that astonishing uneasiness, panting, and struggling, by all the force of respiration to throw off the oppressing load. Hence we conclude, that there is at this time great danger of death, and reason to fear lest the blood, which almost stagnates in the larger veins, should run into polypous concretions, which are often not to be dissolved again during the remains of life.

He therefore is not to be esteemed a good Physician, who only takes notice of the phenomena of diseases, but he that weighs them, and is able to point out what are the necessary consequences following from them.

Nor yet is this sufficient, but it is farther requisite that he compare them with each other; for the extreme cold of a quartan, will be followed by a heat gradually increasing till it comes to be extreme; but
heat

heat distends, lengthens all the solids, and increases the bulk of the fluids; the solid fibres therefore which were shortened by the preceding cold, will be lengthened by the subsequent heat; but nothing weakens the frame of the solids more, than this alternate change of contraction and relaxation: Hence it is we so often see a great debility following after a stubborn quartan ague, and the many other evils subsequent from it.

This is the second use we are to make of the phenomena which appear in diseases; the first was to consider each of them apart, intensely, and in a separate view, and then collect them together in writing for the help of the memory; the second use was to consider them conjointly and thoroughly; and by so doing we shall attain to the utmost degree of certainty that the art is capable of.

He farther considers them in an opposite view to such things as happen in a state of health.] This is a rule of the greatest importance in the art. The wise Hippocrates, in his *Prognostics*, has deduced presages which have been approved of in all the ages which have passed since; he there directs us to consider well the face of the sick, whether it be like that of a person in health, but especially if it be like what it formerly was; and says the worst state of it is, when it is diametrically opposite to a healthful countenance, when the nose is sharp, the eyes hollow, &c. describing that kind of countenance which has since been called by Physicians the *facies Hippocratica*. He compares the manner how his patients lie in bed with their usual custom of lying when in health, and so far condemns the latter as it departs from the former; so he condemns a quick answer from a man that had been of a cool temper before; so any unusual action, or great expression of concern for a matter which before was not much regarded, is set down in his *Coacæ Prænotiones* as an ill sign and nearly approaching to a delirium. Innumerable other instances of a like nature are to be found in Hippocrates, but these may suffice.

For there is no symptom appearing in diseases, but it is the effect of some function disordered, which was exercised in health, and the greatness of the disease is proportioned to the degree of its departure from what it was in a state of health.

And lastly by the use of his reason, &c.] For he that examines the coldness of a quartan ague according to the rules laid down, will conclude its proximate cause to be the circulation diminished, through the expelling power of the heart's being lessened, or the resistance at the extremities of the arteries increased, or both together. But why is it here expressly said, that we shall thus attain to the knowledge of the proximate cause? Because the possible remote causes may be very many nor all easy to be known; but by knowing the proximate cause, the proper means are discovered for taking it away: for when I know what it is that causes the cold in a quartan, I easily conclude what is to be done to cure or at least to mitigate it: a thin, warm, light aromatic drink, gentle friction, diluting the liquids, relaxing the vessels, and gently exciting the vital powers, compleat the whole. Physicians of old advised in this case the use of bathing, to prevent the access of this coldness in a fever.

When Physicians have taken a different course, how widely have they erred from the truth! Thus upon observing that certain bodies when mixed together shall occasion an effervescence, and at the same time produce cold; they scrupled not to say, that a like cause produced the cold in a fever: whereas death produces a greater cold than is to be found in any quartan.

S E C T. XIV.

THE best method therefore for describing the history and cure of diseases will be, &c.

The true method is here delivered in which diseases ought to be described and cured; I wish it were always

ways observed : for when a case is to be communicated to others for a consultation, many Physicians describe not the appearances of the disease itself, but content themselves with delivering what they think of the disease, leaving it to consultation only to determine what in this case should be done. But sure it is highly necessary, to describe all the phænomena observed through the whole course of the disease, that the other Physicians who are consulted may likewise judge of the nature of the disease, and thence deduce the just indication of what is to be done. But the best method of doing this seems to be by observing the following rules.

I. To set down the individual symptoms of each particular disease, such as are peculiar to it, and such as are common to other diseases, in a distinct manner, in a proper order, and with the strictest truth.

I. All those appearances in a disease, wherein it is known to be different from a state of health, are called symptoms ; now these are individual and proper, and constantly occur in every description of the same disease, and can never be separated from it ; as for instance, in a pleurisy the sharp pricking pain, which is felt more violently upon drawing in the breath, attended with an acute continual fever ; these are termed pathognomonic signs.

Besides these, there are such as are common to this disease with many others ; as for instance, in a pleurisy the pains of the head, loins, &c. which do also occur in a thousand other diseases, are therefore called common. Now all these are to be set down in their proper order, as they mutually succeed each other, otherwise the end of the description is lost ; thus to say, that in the small-pox the patient was delirious, would be to say nothing from whence any certain

prognostic could be formed; for it makes a great difference, whether the delirium comes on before or after the eruption; and if Physicians in former times had not observed this, how could they have foretold what would happen on the seventh day, from what appeared on the fourth?

It is a saying of Hippocrates (*a*), *præterita discere, præsentia noscere, futura prædicere, oportet*; “past things must be learnt, present known, and things future be foretold.”

With the strictest truth.] All these particulars are to be set forth as they have occurred in the course of the disease, and must not be wrested to any pre-conceived hypothesis.

2. To rehearse all that happened to the patient from those things which he has either done, taken in, retained, voided, or applied, during the disease.

2. This rule is of the utmost consequence, and without it the description of diseases will be all obscure and confused. For whatever is taken in or applied to the body changes it, and in its turn is changed by it; which changes we should carefully distinguish, and not confound with those which arise from the nature of the disease. For diseases differ very much according to their different treatment. How greatly different has Sydenham observed the small-pox to be when treated with the hot and cold regimen? how much worse is every circumstance in acute diseases, when the patient can get no rest? what irregular symptoms occur in diseases from the imprudent application of cantharides, mercury, arsenic, &c. tho’ used only externally? for all these do not act alone, but in conjunction with the disease; nor does the disease act alone, but in conjunction with them.

3. To

(*a*) Epidem. Lib. I. Charter. Tom. IX, pag. 58.

3. To relate the advantages received from diet, surgery, or medicine, together with the true method of their being applied, just as either chance or art suggested them.

3. Every thing is to be candidly recited which has been observed to do good or ill in diet, surgery, or medicine; nothing is to be dissembled. Hippocrates ingenuously (*a*) acknowledges his mistake, when in a wound of the head he distinguished not a stroke of a dart from a future of the skull; and many of the persons died, whose diseases he describes in his discourses of epidemic distempers; whereas most writers of observations relate only their good success and conceal their ill.

4. To mark down the conclusions, which according to the directions given (13) may be rationally and fairly drawn from these three, as *data*, as so many safe rules of practice.

If now the Physician has faithfully observed the three foregoing directions, he may from these *data*, by just reasoning, deduce the most unerring rules, which will immutably serve to direct him in his practice. Thus when we know by undoubted observations, that a quartan ague while it lasts keeps off the attacks of an epilepsy, nay sometimes entirely cures it; we hence justly conclude, that a quartan coming on after an epileptic fit is to be left to itself, and by no means to be meddled with.

Whilst Sydenham looked upon a new disease, as something he had never been acquainted with before, he took notice that some of the applications made to his patients proved beneficial, and others prejudicial, that nature seemed to point out a particular course,

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and

(*a*) 5. Epidem. Charter. Tom. IX. pag. 340, 341.

and that by opposing this direction every bad symptom became worse; and from hence he deduced the method of cure, in which he so happily succeeded, and by which he deservedly obtained so great an authority in the profession.

This fatigue of observation he was forced to undergo as often as a new epidemic constitution arose, which though it seemed enough to resemble the former, yet if treated in the same manner was followed with very ill success, as he so ingenuously confesses; and yet by this method of enquiry he discovered a new and certain method of cure.

Being thus forewarned therefore that there is often such a difference in diseases which appear alike, we are to search out the hidden nature of diseases by the rules here given, that we may be able to assist the sick in a proper manner.

S E C T. XV.

THE multitude of diseases make their due arrangement the more difficult.

Whoever is thoroughly acquainted with all the branches of knowledge, which are at this day discovered in the art, will find himself in no particular more at a loss in describing the history of diseases, than in determining where he ought to begin, how to proceed, and where to end, and indeed even among the best authors we meet with different methods, some beginning with the formation of the chyle and its disorders, and from thence proceeding to sanguification; others running over the body from head to foot, and relating the diseases of every part; but in all these methods there are great difficulties; the following paragraph seems to point out the order, which is most simple.

S E C T.

S E C T. XVI.

BUT it is most natural to treat them first, which are most thoroughly known. 2. which in their nature are most simple ; 3. which are most easily cured ; and 4, which are necessary to be known in order to understand others.

1. It is an established rule in all sciences to begin with such particulars as in themselves are most evident ; and the geometricians, the best masters of truth, by thus gradually proceeding from a few postulata, so clear, that no body in his senses can doubt of them, have thence deduced an infinite number of the most beautiful propositions.

2. That would be the most simple disease (if there were any such) which had one symptom only ; for if another disease had two or three, it were proper to begin with the former as the most simple : for thus all regular science proceeds from the most simple to the more compound.

3. That cure is to be called the most easy, which immediately discovers to the person considering the disease the necessary steps that lead to it, and which does not require any great application of art.

4. But we must be particularly careful that the disease be first explained, which is necessary to be known before others can be understood. In this place the celebrated author of these Aphorisms used to tell his hearers, that having set down all diseases in writing, he then applied to them these four rules, and thence drew the following conclusions.

S E C T. XVII.

Building therefore on this foundation (16) we shall proceed to treat of diseases in the following order.

S E C T. XVIII.

WE shall begin with the several kinds of diseases, that are most simple.

This follows of itself from what has been said.

S E C T. XIX.

OF these therefore the diseases of the solid parts require in the first place to be explained and cured.

For all diseases are either of the solid or fluid parts, or of both together: but the nature of the fluids is much more intricate and compound than that of the solids; we are to begin therefore according to the fore-mentioned rules with the diseases of the solids.

S E C T. XX.

OF these (19) the explication and cure of the diseases of the most simple solid fibre ought to be the first.

Of all the solid parts of the body we can conceive none more simple than a fibre; for vessels consist of membranes and these of fibres: now a fibre is a part of the human body considered only as extended in length, but as having no parts in breadth, and may therefore be compared to a mathematical line, which is defined to be length without breadth: but let the length of the fibre be ever so great, it is still considered as a most simple part, provided that all breadth be excluded.

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The DISEASES of a simple solid FIBRE.

S E C T. XXI.

THOSE parts which being secreted from the fluid contained in the vessels, and applied to each other by the vital powers, and the assistance of a most fine aqueous or fat gluten, compose the least fibre, are very small, most simple, earthy, and scarce capable of being changed by any of those causes, which are found to act in us during life.

The most simple fibre consists of very small parts adjoining to each other length-ways: these parts which are not divisible into less are called the elements of the fibres. For by an element is meant every the least part of that thing whereof it is an element (*a*). A fibre that consists of two such elements or elementary particles adjoining to each other length-ways is the least of all. One such elementary particle considered by itself does not make a solid, but is ranked among the fluids; it is a combination of the elementary particles that constitutes a fibre.

How then are these fibres produced? Certainly an adult man, who weighs two hundred pounds, in his first original lay concealed in a very little drop of a feminal liquid, and from so small a beginning growing up to so large a weight, owed all his increase in the solid parts to the supplies he received from the fluids, as appears from the observations of Malpighius, attempted of old by Hippocrates (*b*), upon the

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(*a*) Galenus de Hippoc. & Platon. placit. Lib. VIII. cap. 2. Charter. Tom. V. pag. 229.

(*b*) De natura pueri, cap. X. Charter. Tom. V. pag. 322.

incubation of eggs; in which we see the young chicken grows in one and twenty days, from too small a bulk to be seen by the naked eye, to have very firm parts out of the liquid of the white attenuated by incubation.

But this liquid of the white must be yet farther attenuated and perfected by the organical structure of the young one, before it can pass those vessels, which by reason of their minuteness exceed all conception.

And yet this most subtle fluid was the vehicle to these elements of the solid parts.

From hence therefore it is reasonable to conclude, that the particles which constitute a solid fibre are the smallest of all.

But they are also the most simple.] For if any thing could be conceived more simple, they would not be elements by the definition.

Earthy.] It may seem perhaps a bold undertaking thus peremptorily to pronounce what the nature of the body is, which constitutes the fibres. We call that earthy, which dissolves not in water, nor melts by fire, but continues fixed. Now the solid parts of animals, after being deprived of all their more volatile parts by a chemical analysis, yield at last just such a substance. Does not putrefaction shew this, which in the most perfect manner separates the earth from the other principles? a human body buried for some years, when taken up and surveyed, what does it exhibit? If it is not grown dry and hard, as is sometimes the case, every part retains its original figure, so that even the face may be known; but with the least shake the parts fall altogether, and nothing remains but a little very subtle earth to cover the bones, which generally remain firm still. And these very bones, being long exposed to the air, or burnt in an open fire, leave a mere earth behind, all the other parts being hereby dissipated.

And scarce capable of being changed, &c.] The assayers, who prove metals by melting them with lead in a very brisk fire, make their best crucibles of this earth,

earth, which like a sieve suffer the lead to pass thro', and detain the more valuable metals. Is it credible now that these parts, which are immutable by this violent action of the fire, should ever be changed by any causes known to act in us while we are alive? They may cohere to one another, and this cohesion may be dissolved, and the particles in all other respects remain immutable.

It may seem strange indeed, that so fixed and indissoluble an earth should lie unseen in the most subtle liquids. But chemistry shews us that this is possible. The most limpid saline alkaline spirits of animals, raised by fire, have earth in them: animal oils obtained by distillation, though very pure, leave some earth behind, whenever the distillation is repeated; and will at last fly off, when they have deposited all their earth. For this earth it seems gives a stability to the other principles.

But in order that our solid fibres should be composed of these earthy elementary particles, it is requisite that they cohere together. This is wrought in us by the power of life applying new elementary particles to the fibres already formed in the places of those that are carried off, and this we call nourishment: and so far as appears from the consideration of the thing itself, though we do not yet perhaps know the true manner of it, this is effected by the interposition of an aqueous or fat gluten, for water hath an incredible power to unite bodies together. The powdered lime of alabaster (which is called *gypsum*) is so light, that it may be dissipated with the least breath, but by mixing water with it, it is made into a ductile paste, and this paste in a little time hardens into a stone. Shells burnt to lime are capable of being ground into an extremely fine powder, which is often prejudicial to the lungs through its volatility and lightness; but if well mixed with water it becomes a paste, which by fire may be turned into the hardest stone. Even in the most solid parts of animals, where none would suspect
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there was any intermixture of water, it lies in an incredible quantity. Distil the dryest ivory or hartshorn, which have lain several years in the shops, in a glass retort, and the greatest part will become volatile, and pass into the receiver, and thus a great quantity of an aqueous liquid is by this means obtained from it, whilst what is left behind becomes brittle.

Was this the meaning of the wise Homer, when none of the Greeks accepting Hector's challenge to a single combat, he makes Menelaus in a rage imprecate as it were annihilation, and say (c).

Ἄλλ' ὑμεῖς μὲν πάντες ὕδωρ καὶ γαῖα γένοσθε.

To earth and water may you all be turn'd.

But the same cohesion of the earthy parts may be effected by means of a fat gluten, as we learn also from chemical experiments. For as long as that last oil adheres to the parts of animals, which is not to be separated but by the force of fire in the open air, they still cohere; but this being expelled they fall asunder. Bones calcined and made very brittle, if dipped in oil, will cohere again.

S E C T. XXII.

IN these elementary particles therefore (21) separately considered, no disease has ever been described, as observed or cured by Physicians.

If now these least elementary particles, which constitute by their union the most simple fibre, be considered apart by themselves, we know nothing that can be affirmed of them: and they who by subtle speculation have attempted to discover the diseases to which they are subject, have hitherto said nothing to the purpose. That they may break off from one another and have their cohesions changed, is what we easily con-

(c) Homer. Iliad. Lib. VII. ver. 120.

conceive; but the same face of things constantly persevering for the space of 6000 years, makes it highly credible, that the elementary particles of bodies are absolutely unchangeable.

These elementary particles of the solid parts may be considered, either as being contained in the fluids and with them flowing through the vessels, and then their diseases, were they known, would be the diseases of the fluids; or else as when united they compose a solid part; but then they are no longer elements, but a solid composed of the elementary particles.

S E C T. XXIII.

BUT in the smallest fibre, formed by the (21) union of these elementary particles, the following (24 to 38) most simple diseases deserve to be considered: for they frequently occur and lay the foundation for the understanding of others, though frequently overlooked or not well understood.

The most simple diseases of all therefore are not to be sought for in any default of the elementary particles, but in the least fibre made by the uniting of these together. For if but two elementary particles cohere together, their different cohesion may cause a disease; and as will be shewn hereafter, the too great or too little cohesion in the simple solid fibres, and in the vessels and viscera formed from them, may give rise to innumerable diseases.

Now these diseases have been generally over-looked; for even the Methodists, as they are called, who are reputed the authors of the doctrine of astriction and laxity, have never treated of these.

This appears from the account of their doctrine given by Celsus (a). *Satis esse credebant*, says he, *communia*

(a) Lib. I. in præfatione, pag. 15.

munia morborum intueri, & quidem horum tria genera esse; unum adstrictum, alterum fluens, tertium mixtum. Nam modo parum excerne ægros, modo nimium; modo alia parte parum, alia nimium; “they judged it sufficient to consider some of the common properties of diseases, which they made to be threefold, the one bound, another loose, and the third mixed; for at some times the excretion of the diseased,” they said, “was too little, at other times too much; sometimes there was too small a discharge in one part, and in another too large.”

The DISEASES of a weak and lax FIBRE.

S E C T. XXIV.

THE weakness of a fibre is the union of its minutest parts (21) with so small a degree of cohesion, as to be capable of being dissolved by that light motion which is the effect of health, or by a motion, which does not much exceed it.

Whatever be the cause of the cohesion of the elementary particles which constitute a fibre, it will easily be conceived, that the force with which they cohere may be increased or diminished. Our vessels composed of these fibres ought to yield to the impulse of the liquids contained in them and be distended, yet not beyond certain limits; the cohesion ought still to remain without a rupture. There is therefore required a certain and determinate degree of cohesion in these fibres, which if it be increased or diminished will constitute a disease.

The weakness therefore of a fibre can never be defined, otherwise than relatively: for in the first weeks after conception, those first rudiments of the human body

body are so soft as to melt between the fingers, and if they were not sustained by the equable pressure of the surrounding fluid, would fall into a shapeless mucous mass. So small is the cohesion required in the fibres at this time: and yet how great a strength of cohesion is requisite in the fibres of adult persons?

In different parts of the same body also there is required a very different degree of cohesion. The cohesion of the smallest solid particle, which forms the soft pulp of the auditory nerve, is surely much less than of that which constitutes the hard tendon, which is called the tendon of Achilles.

Hence therefore a solid fibre is then said to be too weak, when it cannot without injury to its cohesion sustain that motion, which is requisite in health to the exercise of the functions.

Neither is this altogether sufficient, they ought also to have strength enough to sustain a force somewhat greater. For if these minute solid particles cohered with no greater force than barely to sustain the gentle motion of the liquids through the vessels in health and no more, their cohesion would presently be destroyed, when the liquids were propelled through the vessels with a greater momentum by any increase of the circulation. For the velocity of the circulation is increased by very slight causes, and such as no human prudence can avoid; as upon a sudden noise the heart presently falls into a palpitation, and all the arteries beat very swiftly; so laughing, coughing, sneezing, will all very much accelerate the motion of the blood.

In diseases we sometimes see the unhappy condition man is reduced to, who has his solid fibres so weak, as to be but barely able to sustain the most gentle motion.

Such persons as spit blood through the breaking of an artery in weak lungs, will live tolerably easy, if they keep themselves quiet, if the quantity of blood distending the vessels be lessened by bleeding, and they take in no diet capable of exciting any violent motion

motion or irritation ; but if any violent fit of coughing seizes upon these unhappy people, or they imprudently bawl out aloud, or are agitated by any strong passion, and thus the impetus of the blood passing through the lungs be increased, the too tender pulmonary vessels are by this means burst, and the blood rushing out into a stream very frequently carries them suddenly off.

S E C T. XXV.

THE antecedent causes are ; 1. An imperfect conversion of the food into a like nature with that of an healthy vital liquid, which is owing to a too great deficiency of the proper digesting humours, and the sluggish action of the solids upon the liquids, or to a naturally greater tenacity in the food than the powers appointed to change it in the body are able to conquer. 2. Too weak an application of one part (21) to another, which is caused by too weak a motion of the liquids, and this generally by a defect in the motion of the muscles. 3. Too great a distension of the fibres so as to be upon the point of breaking.

1. It is a most certain truth that we consist of the things we are nourished by ; but the matter which nourishes must undergo a preparation in the body before it can nourish ; so that food alone is not sufficient for this purpose, as was observed before in the explication of the first aphorism ; there is besides required a healthful state of the natural functions in order to produce this assimilation of the food into our nature, and restore what has been carried off by the activity of life. Some Physicians have wondered why when they ordered the most nourishing food in a desperate consumption, it should be attended with no benefit ;

ness; but the reason is, that in this case the assimilating power is wanting, without which no nourishment can be obtained. Galen therefore deservedly blames the Physicians who did not attend to this, (a) who were Methodists in name indeed, but in their actions wanted all *just* method (*ἀμείβοδης*), since they gave flesh and wine, &c. in such cases, and so poured nourishment as it were (*eis ἀΨυχον ἀγγος*) into a lifeless vessel.

Which is owing to the too great deficiency of the proper digesting humours.] If we consider the several circumstances intervening before the crude food is converted into our own nature, we shall see that an incredible quantity of human liquids is mixed with it. While it is chewing, the saliva and mucus of the mouth, the tongue, the palate, the jaws, &c. in the stomach the gastric juice, and in its passage thence the two sorts of bile, and the pancreatic juice, and in every point of the intestines fresh humours already perfected by the organs of the body; when the chyle is received into those fine tubes, the lacteals, it is diluted with a prodigious quantity of lymph in the thoracic duct, the lymph returning from almost every part of the body is poured into it; from whence the chyle passing by drops into the subclavian vein, is swept away and swallowed up by the whole torrent of the blood. Hence therefore we may justly conclude, that among the principal causes of assimilation, is to be reckoned the mixture of a little crude aliment with so large a quantity of concocted humours.

This truth is farther confirmed by experience. For when the blood of the most robust soldiers is in great measure drained off by their wounds, though they swallow down their food with greediness, they shall yet not be able to digest and convert it into good blood, but the whole contexture of the body being hereby weakened, they shall languish and be drowned in a dropsy.

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(a) De ratione victus in morbis acutis ex Hippocratis sententia, cap. IV. Chart. Tom. XI. pag. 189.

In abortions where there has been a considerable loss of blood, how great a languor follows thereupon and of how long continuance !

All the other evacuations in excess by stool, urine, sweat, &c. produce the same effect.

To the sluggish action of the solids on the liquids.] When fresh chyle mixed with the blood, has for some time been acted upon by the arteries of the lungs and of the whole body, it acquires the nature of milk. But milk approaches nearer to our nature than chyle. After a long time, as Lower (*b*) has shewn, it puts on the nature of serum. But during all this while it endures the action of the vessels on the liquids, which consists in the re-action wherewith our vessels repress the distending fluid. The firmer therefore these vessels are (provided they be not too rigid to yield to the impulse of the liquids) the greater is their action, and so much the sooner and better is the food assimilated into our nature.

A weakly girl languishing under a chlorosis, takes in aliment indeed, but does not convert it into good blood, only into milk as it were, from whence arises the universal paleness; nay, when a vein has been unadvisedly opened in this case, I have seen white blood flow from it; if a person under this complaint increases a little more in strength, the aliment is more changed, yet not perfectly elaborated; then the colour becomes yellow or greenish. The cause of all is the defect of the action of the solids on the fluids, whence these persons swell, and are filled with crude humours, and are not well nourished.

Let the force of the firm parts on the contained fluids be increased by steel and bodily exercise, and the tumid face shall begin to subside, the lips and cheeks become tintured with the colour of the lovely rose, and the wonted vigour return to the whole body :

Or to a naturally greater tenacity, &c.] The mixture of a very large quantity of concocted humours
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(*b*) De corde, pag. 239.

with a very little crude chyle, and the action of the solid parts on their contained fluids, have been assigned as the principal means that conspired to change the crude food into our substance. But though their action be so efficacious as at last to produce human blood out of so many different sorts of aliment; yet there is required in the aliment itself a disposition to be subdued by the changing powers of our body. (c) *Ipsa enim concoctio est in coquentis substantiam (ἡσίου) deductio quædam ejus, quod concoquitur; corpore igitur secundum naturam habente, quando & concoquendum familiarem habuerit naturam respectu coquentis, mutatio & alteratio totius substantiæ coquendæ fit, aut maximæ ejus partis, paucissimo nobis immorante semiconcocto;* “for concoction itself is a
 “sort of reduction of that which is concocted into
 “the substance of that which concocts. When the
 “body therefore is in a perfectly sound natural state,
 “and the nature of the food to be concocted has a
 “proper affinity with that which is to concoct it,
 “then follows a change and alteration of the whole
 “substance of the food, or at least of its greatest
 “part, very little remaining half concocted.”

In sieges, where people are forced by famine to eat any thing they can find, they all grow weak and languid. Thus when for want of provision “at Middleburgh in Zealand (d), they lived on bread and cakes made of linseed, the hypochondria were very soon hereby distended, the face, and other parts, became swollen, insomuch that many died of the distemper.” The reason was, that the invincible gluten of the linseed could not be converted into proper nourishment.

When girls through a depraved appetite take to eating sand, lime, wool, and other such trash, how weak and pale they grow!

The tenacity of our food therefore ought to be proportioned to the assimilating powers; otherwise the body will be oppressed and not repaired thereby.

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(c) Galen. Comment. 2. in Epidem. 1. Chart. Tom. IX. p. 55.

(d) Dodonæi Stirp. histor. pag. 534.

When the poorer people give their tender infants unfermented farinacious cakes, potatoes, &c. these poor children have their bellies swell immoderately, while all the rest of their body grows less.

It was with a view to this, that Hippocrates (c) ordered the use of a very light food, while a disease continued in its full strength; for nature being then oppressed by the force of the disease, he knew, was not able to digest properly food that was stronger; and from this principle he deduces in another place many salutary rules of diet.

2. When a very healthful person is drowned, his solids and fluids continue as before, yet is there no assimilation, nor is any fibre nourished; the reason is, because the power of life is wanting to distribute, move, and apply. For though such food be taken down, as shall consist of particles proper to restore the fibres, yet if these be not applied and fixed by the power of life, no nutrition will follow.

In those diseases where the vital circulation of the humours is languid, though you give the most nourishing food, it is to no purpose; you may cram such bodies 'till they swell and are overcharged, nay almost suffocated; but you cannot nourish them, as we see in the case of a dropfy.

Now the diminution of the velocity in the circulating fluid, is the chief reason why the elementary particles are justly applied so as to procure the nourishment of the fibre.

But the origin and fountain of the vital motion seems to reside in the heart, by whose motion the blood being driven out of the ventricles of the heart, all the arteries are dilated, which soon after contracting again, perpetuate the motion of the blood that was driven into them.

Now one of the principal causes of the motion of the heart, peraps, is the influx of the venal blood into its cavities; for long after death, if the venal blood

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be protruded towards the right ventricle of the heart, its motion returns, as appears by most certain experiments. But when the muscles act, they by their swelling compress the adjacent veins, and so accelerate the motion of the venal blood towards the heart; and the heart hereby irritated is contracted more swiftly, from whence arises a quicker circulation of the blood.

This is confirmed by most certain experience. If two brothers born of the same parents fall into a different course of life, and one applies himself to the study of Philosophy and lives a sedentary life, whilst the other adds firmness to his body by hunting, riding, and warlike exercise, what a vast disparity may we observe in their strength? The former like a puny girl is weak and sickly; whilst the other, who has enured his body to labour, shall acquire by this means very near the strength of an Hercules.

Let an horse that has been daily used to strong exercise stand quiet in the stable, and he shall soon grow plump and sleek with fatness, but at the same time he will become much weaker, and altogether unable to undergo his usual labour.

Rest makes the body moist and weak; labour makes it dry and strong (*f*).

3. Nothing shews the impossibility of explaining the nature of particular bodies by mechanical principles more than cohesion, that wonderful property of bodies. The parts of iron cohere together, that iron is drawn into wire fit for the strings of a musical instrument; by turning the screw this wire is drawn longer and finer, and of course fewer particles must touch each other; strain it still farther and at last it shall break, but though you put the broken ends together they will never after cohere. So that cohesion may by degrees be so diminished, as at last to become none at all, and so the moment before the wire broke the cohesion was scarce any, or at least so inconsiderable,

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(*f*) Hipp. de victus ratione sanorum, Lib. II. cap. 10. Charter. Tom. VI. pag. 474.

as to admit of a separation upon the intervention of the least external force ; and the case is the same with our solid fibres.

One way of torturing malefactors to make them confess, is to hang weights to their great toes, and gradually increase them. Such persons as have suffered this punishment for some days shall scarce be able to move their limbs, but become in a manner paralytick purely from this distension.

The bladder, when stretched beyond its tone by a retention of urine, shall lose its power of contracting: the skin and *panniculus adiposus* in the abdomen of a pregnant woman shall continue flaccid and wrinkled all her life, though the foetus which distended it be excluded.

S E C T. XXVI.

THE effects it produces are the easy extension of the vessels composed of these weak fibres (24), their rupture or sluggish action on their contained liquids ; whence tumours from their distending liquids, putrefaction from the stagnation or extravasation of them, and then the numberless other consequences which follow from these.

This will clearly appear, if we suppose a human body that is in perfect health to be at once made too weak in all its solid fibres : now as all our vessels consist of fibres contorted and wove together, the strength of all the vessels depends on the strength of these fibres ; but the greater or less capacity of every vessel is computed in a compound ratio of the force of the impelled liquid directly, and the resistance of the sides inversely ; when therefore the fibres which constitute the sides of the vessels are weakened, and the resistance of the sides is hereby lessened, while the force of the liquid

quid impelled remains the same, the vessels must necessarily be distended.

If any part of the body, suppose the foot, be exposed to the vapour of warm water, than which nothing weakens more, it will soon begin to swell and become oedematous.

If the same cause proceeds to weaken the fibres, the least force will at length destroy the cohesion; *i. e.* make a rupture; as we often see in the unhappy case of tender constitutions, where an artery shall burst in the lungs by so small a circumstance as coughing, singing, or calling aloud.

Sluggish action on the contained liquids.] The arteries, when distended by the impelled liquid, repress the fluids by the force of their own fibres; and by this endeavour of the fibres to diminish the capacity of the vessels which they constitute, they press the liquids contained in them, strike forcibly upon them, and change them; and on these two actions depends whatever is wrought in the body. When therefore the strength of the fibres is diminished, it plainly appears, that the action of the vessels which are composed of them upon the fluids contained in them must likewise be lessened.

Tumours from the distending liquids.] The reason has been already given, and stands confirmed by most certain observations. When a tender maid begins to be debilitated in a languishing chlorosis, first those very lax places under the eye-lids (called by the antient Greeks *ὕπωπυα*, *ὕποφθάλμια*) begin to swell, next the whole face appears to be somewhat bloated and pale; and as the mass of humours to be moved daily increases, while the moving cause is not increased, she begins to swell all over in almost every part of the body. Thus in the beginning of a leucophlegmatick habit, men are often pleased to think they are perfectly well and grow fat. When the air has continued musty for several days together, the bodies of all persons whatsoever seem inflated, because the external parts in this

case lying in a kind of perpetual bath are thereby relaxed, and yield to the distending liquids.

Putrefaction, &c.] So long as the humours circulate through the vessels with an equable motion, no putrefaction is bred in the body; whatever is disposed to putrefy being carried off by the usual emunctories. But when the debilitated solids can no longer propel the distending fluids, a stagnation follows; and as all animal liquids will putrefy, when left to themselves, in the heat of common air, (except only milk, which has not yet acquired all the properties of a human liquid, and perhaps the fat) much more will they be apt to putrefy when exposed to the heat of our bodies, which always exceeds the heat of the common air: so also in the case of a ruptured vessel and an extravasation of humours.

If now we apply these observations to the various parts of the human body, we shall find that numberless and most grievous evils take their rise from this simple cause.

If the lungs be too tender to bear the force of the blood that is driven from the heart, the vessels will burst and bring on a spitting of blood, from whence so often follows an incurable consumption.

If the vessels of the brain should chance to grow weak, and be either too much distended, or burst and extravasate their humours, every disease of the animal functions may follow upon it, from the lightest vertigo to a mortal apoplexy. And so of the other viscera; but these examples may suffice.

S E C T. XXVII.

FROM the three foregoing Sections (24, 25, 26) the present, future, or past debility of the fibres is known: the effect is foreseen; and what is required to work a cure evidently discerned.

Whoever

Whoever therefore understands thoroughly what has been already said concerning the nature of a simple fibre when too weak, what it is that precedes this weakness, the appearances which discover it, and the effects which follow it, will easily be able to determine whether the fibres of his patient be too weak or not. This in physic is termed the *diagnosis*, or clear notion of the present disease, as absolutely distinct from every other disease, and comprehending in it the individual nature of the disease. This diagnosis is acquired by knowing first, that such physical causes have preceded, as have ever been found before to give rise to this disease. For instance, if a man of naturally a weak constitution has accustomed himself to bathing in warm water, to the drinking of small liquors warm, and farther indulged himself in sloth and inactivity, then I know that such causes have preceded as render the fibres weak; and this is the first foundation of a diagnosis. The other is the knowledge of the disease considered in its own nature and present effects; which if they appear to the senses become the object of their observation; but in case of a more latent disease, its nature is discovered by knowing the effects which proceed from it as a cause; whoever therefore knows the effects of a weak fibre, will be able to discover whether the disease before him be this disease or not.

Prognosis signifies the knowledge of a thing before it happens. It is therefore the knowledge which the Physician has in his mind of some disease that will certainly be, which as yet is not. A disease is known to be future by our knowing that such causes have preceded, as, though they cannot of themselves produce the disease, yet will do it when increased or joined with others. For instance, if a Physician knows that a man is constitutionally inclined to a spitting of blood, he will put him in mind that he has cause to fear this disease may come on, though he has never yet had it; he will bid him be careful not to drink too much wine, or take down too many spices, to avoid speak-

ing aloud, singing, &c. for the prognostick is not to be drawn from the knowledge of a cause already perfectly formed in the patient, for then the disease would be present, but from the knowledge of some physical cause, which pre-disposes to some certain disease as a part of the total cause; to which the Physician foresees another cause may soon be added, which will render the former pre-disposing cause compleat. Thus when a man lies sick of a pleurisy, and a prognostick is required of the Physician, and he sees the distemper is not attended with immediate danger, yet that it is not carried off by nature, nor the material cause of the disease expelled by any critical evacuation or translocation, and withal, that the medicines which have been applied have not proved effectual, he will then prognosticate that this pleurisy will end in a suppuration; and this prediction shall not be derived from the present pain of the patient, but from this circumstance joined with such causes as occasion an inflammation to end in a suppuration.

And thus we may clearly understand, what is meant by diagnosticks and what by prognosticks.

If then the alterations which a disease, whose diagnostick signs are thoroughly known, has wrought in a body that before was in health, be carefully observed, I am able from the seeing of these alterations wrought in the body of my patient to pronounce, that he labours under this disease. This judgment is termed *ἀναμνησις*, or a *recollection* of the disease.

What is required to work a cure.] This is the great end proposed by the art: for the cure is so to change the present physical condition of the body, on which the disease depends, as to restore the injured functions to a sound state, and at the same time to preserve life.

For when from the diagnosticks of the disease we have learnt its particular state, increase, &c. the part, affected and the matter that offends in the said part, and have formed a prognostick, what is to be hoped for and what to be feared; and then too from all these concluded

concluded what things are to be done : these are called the things *indicated*, and the knowledge thus produced in the Physician's mind is termed the *indication*.

And here first we are always to consider whether the disease be to be left to nature, or whether any assistance is to be given by art ; for as the sick man lives, and many things will be wrought in him by means of the life remaining, which are not yet wrought, if the changes which life of itself will make be such, as from certain observations are known to be capable of altering the cause of the disease, in such manner as health shall return, then is nothing to be done. For example, if a pleuritick person in the first stage of the disease coughs up a mucous yellow matter streaked with blood, and finds relief in every symptom, we know from the faithful observations of the Antients, that if this expectoration can be kept up, he will be well in a few days ; for which reason we are not to disturb this salutary attempt of nature, by bleeding or any other remedy, but are only to throw in such very smooth decoctions, as may serve to support this expurgation. But if, for example, in a pleuritick patient we observe a violent fever, a burning heat, a dry cough, attended with a dryness of the tongue, and no sign appears, from whence we may learn that nature is aiming at any salutary change, we then know, that if things go on in the body as they do, either a mortal gangrene will follow ; or if the disease be of a milder nature, a suppuration, which is always a good circumstance where the suppurated matter can be carried off ; but here lies the danger, lest the purulent matter when formed should be discharged into the cavity of the thorax, and destroy the patient with a fatal empyema : here then we conclude that nature is not to be left to itself, but the disease is to be so changed by the powerful assistance of art, as to prevent either a suppuration or gangrene ; what these assistances are will appear from a knowledge of the nature of the disease and its preceding causes.

S E C T. XXVIII.

THIS cure will be obtained ; 1. By nutriment, in which the matter described (21) abounds, and which is already prepared almost in the same manner, as in a strong and healthy body, of which sort chiefly is milk, eggs, broths, panada, or decoctions of well fermented bread and rough wines. These are to be taken in a small quantity, but often ; 2. By increasing the motion of the solids and fluids, by frictions, riding on horseback or in a chariot, sailing, walking, running, and all bodily exercises ; 3. By a gentle compressure of the vessels, and a moderate repelling of the liquids contained in them ; 4. By medicines, both acid and austere, or even such as are spirituous and fermented, used cautiously and with moderation ; 5. By any means, that will remove the too great distraction of them.

It is here supposed that there is no other defect in the body, but meer weakness of the fibres ; so that we now consider this disease abstractedly from all others. Now we cannot easily cure the too great weakness of the present fibre, so as to restore it to such a degree of stiffness, as is required in a healthful state, but we can supply such elementary particles for the formation of the fibres, that according to the laws of the human fabric are hereafter to be framed, as shall suffice to give them a due degree of strength.

The first cause mentioned of the too great weakness of the fibres, was the imperfect assimilation of the crude aliment into the substance of the last concocted matter, which is the most subtle of all others, and runs in the smallest vessels. Now to make the fibres strong
there

there is required a substance proper to be applied to them : but this is such a substance as having undergone the action of all the viscera and vessels according to the laws of a healthful body, has acquired the last and most finished degree of perfection : but as the fibres are now supposed to be too weak, and the action of all the vessels on their contained fluids depends on the due strength of the fibres, the several functions employed in changing the crude aliment into our nature will be less able to discharge their office, and consequently the last concocted matter subservient to nourishment in such a body will not be duly prepared. For this reason it is, that Physicians often wonder, why very good food given to a man in this weak state does not procure proper nourishment ; but as this food only supplies the remote matter, out of which the vital functions are to form nourishment, when these functions are injured, let the food be ever so good, it is given in vain.

While the tender embryo lies in the mother's womb, it is nourished by the humours which have been prepared by the mother ; for so weak a little body could not draw its nourishment from any other body less assimilated. When it is born the milk supplies it with humours prepared in the body of its mother. And thus the medicinal art, in imitation of the method pursued by nature, appoints such nourishment for weak bodies, as is already prepared in the body of some healthful animal, of which the principal is

Milk.] Every man is nourished by milk peculiar to himself, and from this only by the vital powers are all the other solids and fluids perfectly formed. This milk we find in men as well as in women ; and in the latter, though they have never had a child or given suck. We have accounts that (a) milk was drawn from the breasts of a man of sixty years old by suction only ; as also from the breasts of a woman who had never been

(a) Miscell. Cur. Dec. H. An. 5. pag. 60. Append.

been with child (*b*). This milk is the chyle, which after it has undergone the action of the heart, lungs, and arteries, and been mixed with all the other humours, has at length been separated from them by the wonderful fabrick of the glands of the breasts.

Of the several kinds of milk, the best of all for this purpose is human milk, as being most analogous to our nature, and is therefore always to be preferred to that of all other animals. It should be the milk of a sound woman, who uses due healthful exercise, and a laudable diet, and is now in the perfect flower of her age, and is in the best state, if drawn about four or five hours after eating; for by that time the chyle is changed into concocted milk, has lost the nature of the aliments, and begun to assume our own. For there is a great difference of milk according to the different times of its being drawn after eating; that which comes into the breasts as soon as the meal is over, is crude, and retains too much the nature of the nurse's food; that which is drawn twelve hours after is thin, begins to be yellowish, and has a kind of urinous smell, not much unlike the serum of the blood; and consequently that milk is best, which is drawn in the intermediate time.

But there is another thing here principally to be observed, which is, that all animals, which are nourished by the milk of the dam, suck it from the teat, so that it is never exposed to the air, but is given to the tender animal enriched with all its most subtle parts. For there seem to be in the milk some of the most subtle spirits elaborated by the last concoction of a healthful body. This appears from the concurrence of so many nerves in the parts where the chyle and milk are formed, from that most subtle dew which exhales from milk newly drawn whilst it is yet warm, and from those wonderful changes which have been observed in tender infants to have been occasioned by the milk: thus I have seen an infant, that by sucking its nurse when she was
in

(*b*) Miscell. Cur. Dec. I. An. 3. pag. 12.

in a violent passion, thrown into convulsions, though before it was perfectly well.

Besides, it has been the practice of Physicians from the earliest ages to endeavour to restore those that were ready to die through weakness by introducing the effluvia, which exhales from the pores of an healthful young person, into the pores of the weakly and decrepid, by laying them together in the same bed. Thus was the body of David, when worn out with age, cherished by lying in the same bed with a very healthful young woman (c). If therefore milk be given quite cold, or even after it has been warmed again, then that fine subtle part, which is the most wanted, will all be lost.

For this reason Galen writes thus, (d) *Veteres vero etiam mulierem lactantem illis, qui tabe decumbabant, adflare voluerunt, quorum sententiæ & ipse quoque accedo, & quod familiare id sit, & quod priusquam ambiente aëre refrigeretur, id sumi voluerint.* “The Antients advised consumptive persons to have a nurse, who gave suck, always by them, which is a practice that I entirely approve of, both as the milk is a kind of food that is most natural to us, and as they would have it given before it is cooled by the circum-ambient air.”

And again, after a resembling discourse, he compares milk (e) *Semini genitali, quod nec ipsum aliquamdiu extra propria vasa, si modo suam virtutem servabit, morari patitur, sed vel in maris partibus contineri, vel feminae partes tangere debet: & sane optimum lac est, si quis ex ipsis mamillis extraxerit, &c.* “To the genital semen, which will not admit of its being detained out of its proper containing vessels, without losing its virtue;” and adds, “that the milk is best when drawn immediately from the breasts.” After this ridiculing the opiniatry of some others he says, *Quod cum*

(c) 2 Kings, cap. 1.

(d) Method. Med. Lib. V. cap. 12. Charter. Tom. X. pag. 123.

(e) Method. Medendi, Lib. VII. cap. 6. Charter. Tom. X. pag. 160.

cum exhibere sibi, ceu pueris, plerique recusent, utique ceu asinis ipsis dare asinum convenit; "But as many persons do not care to take it, because they will not be treated like children, it is fit truly that such asses should have asses milk given them in its stead."

This is farther confirmed by numerous observations. Capivaccius saved the only heir of a very noble family, by ordering him to lie between two nurses in the flower of their age, and suck their breasts.

A youth at Bologna labouring under a true marasmus, lived upon the milk of a very beautiful young nurse, who lay in the same bed with him, by which means his emaciated body was so well restored, that his friends became apprehensive, lest he should lose his strength, he had gained from her milk, by an unreasonable venery (f).

Where human milk is not to be had, the next best is asses milk, then goats milk, and then cows milk.

Eggs] which inclose so many wonders under their brittle shell, and by the observations of Malpighius, have given so much light into the generations of animals, are likewise used to this purpose.

The white of an egg, agreeing in most of its properties with the serum of human blood, contains in it a liquid, which from the warmth of one and twenty days incubation is so far changed, as to furnish matter for the vital stamen, lying hid in the *sacculus colliquamenti*, to increase to the size of a chicken; for the yolk is not consumed, the white only seems subservient to the nourishment of the young one in the egg.

For this reason it is justly affirmed to contain the best sort of nourishment. Hippocrates said (g), *Volucrum ova validum quid & nutriens & inflans habent; validum quidem, quia animalis generatio est; nutriens, quia lac est pulli; inflans, qui ex parva mole in multum diffunduntur*;

(f) Foresti observat. Tom. I. Lib. IV. pag. 152.

(g) De ratione victus sanorum, Lib. II. cap. 5. Charer. Tom. VI. pag. 469.

tur; "That the eggs of birds have in them something strong and nourishing and filling; strong, because they are an animal offspring; nourishing, because they have the milk of the young contained in them; and filling, because from so small a size they are spread into so large a bulk."

For this reason therefore the white of the egg is principally recommended for the nourishment of weak persons; but diluted with water to take off from its tenacity, and seasoned with a little salt or spice that it displease not by its insipid taste. It must be diluted with water that is warm, for by the heat of boiling water it coagulates into a solid mass that is hard of digestion.

This, however, falls far short of the usefulness of milk; for before the white of the egg can nourish the young, it must be acted upon by the vessels and viscera; whereas there are in milk most subtle humours already prepared by the animal machine.

But the yolk, though it yields a very good sort of nourishment, requires a greater firmness of the viscera; for as Harvey (*h*) has well observed after Aristotle, for some days after it is hatched, the young chicken is nourished by the yolk that is contained in its own belly; for the white is consumed during the time which passes whilst it is growing from an invisible speck in the egg to its due size; and for this reason it seems more easily convertible into nourishment than the yolk.

Galen therefore seems to have meant boiled eggs, not raw, when he commends the yolk as best for weak people, because the white is difficult of digestion (*δυσπεπτον γὰρ τὸ λευκόν*) (*i*) as it clearly appears from another place, where speaking of poched eggs, he expresses himself in very near the same manner (*k*).

Broths.]

(*h*) Harvæi Exercitat. de generatione animal. pag. 93.

(*i*) Method. Medendi, Lib. XII. cap. 6. Charter. Tom. X. pag. 285.

(*k*) Method. Medendi, ad Glauc Lib. I. cap. 10. Charter. Tom. X. pag. 355.

Broths.] Especially if the animals whose flesh is used for this purpose are kept fasting four and twenty hours before they are killed; for then all the crude humours are changed into their due nature by the animal structure: the flesh of animals killed is perfectly juicy, it is little more than the red blood only that is drawn off, all the other humours are left remaining, which mixing in water in boiling supply a matter for weak bodies, that has been already elaborated in the body of a sound animal. But in boiling the most subtle part flies away, which might be preserved if the broth were made in Papin's engine, but broths so prepared have all a soapy nauseous taste, arising from the fat sticking to the flesh, which is so attenuated by the violent action of the fire and water in so close a vessel, as to be thoroughly incorporated with the water; besides these broths are too strong, and stand in need of dilution; so that in the common vessels made deep and covered close, the fleshy substance capable of being dissolved may all be drawn out, and nothing left behind but solid muscular fibres only. These broths, when cold, have the fat swimming upon them, which generally coagulates as it cools. This must carefully be taken off, lest this oily substance, which soon grows rancid, should offend a weak stomach.

But it would be a great mistake to imagine, that the stronger broths are made, the fitter they must be for nourishment; for jelly-broths, as they are termed, rather load a weak stomach by their invincible tenacity, and consequently stand in need of a moderate dilution.

And yet that by thus boiling them in common vessels there is lost a considerable quantity of the most subtle parts, appears from the grateful and reviving smell that issues from the vessels, if they are not well closed while the flesh is boiling.

Is this the reason why those animals are fiercest which feed on the raw flesh of other animals? it is certain

certain that dogs fed on raw flesh become exceeding fierce.

The best flesh for broths is commonly reckoned that of fowls, the next veal, then mutton, and last of all beef (*l*). Excepting the fine part, which for the most part flies off in the common way of boiling, the nourishment remaining resides in the gelatinous part, which broths turn to when inspissated. And we learn from experiments, that veal has more of this gelatinous part in it than beef, mutton a little less than veal, the flesh of any young animal still less, and the flesh of an old cock almost twice as much as veal (*m*). In the Memoirs of the Royal Academy referred to, there is a table, which gives us these different proportions in different kinds of flesh.

The best and most savoury broths are made of veal, mutton, beef, and the flesh of common fowls mixed together; especially if you afterwards squeeze in a little citron or orange juice, to take away their too great tendency towards putrefaction.

Panadas, or decoctions of bread well fermented.] These are of great service to such persons, as living in warm climates are naturally inclined to be thin and lean, and falling into acute diseases are subject to a general putrefaction. The use of the fermentation is to break the too great glutinosity of the flour, that it may not be hurtful. If these decoctions be made of the consistence of whey, they are then most serviceable; if they are made to be as thick as cream, they are less easy of digestion; and if a little spice and wine be added to them they will be still more refreshing.

It is to be observed however, that these decoctions of bread can be carried no farther towards perfection than only to resemble the chyle, so far as it is formed of the alimentary mass, and not as perfected by an intermixture of the other humours of the body, for which

(*l*) Herm. Boër, Mater. Med. pag. 2.

(*m*) Académ. des sciences. Anno 1730. Mem. 314, &c.

which reason these always partake of a vegetable nature. But to form a proper human liquid of the chyle, the action of the lungs especially, as well as of the other viscera and vessels, is required. And for this reason in consumptive cases, and all others where the lungs are too weak, we place our hopes of a recovery in the use of milk only; the decoctions of bread being a sort of food more remote from the last and more proper matter of nourishment than milk.

Austere wines.] There is in all wines a wonderful stimulating faculty, and agreeable to human nature, which excites and diffuses a grateful warmth through the whole body. If they are taken in a moderate quantity by a man not very much used to them, there follows a quickness of all the senses, a very great activity in all the members, and an incredible cheerfulness. Let the philosopher spent with study take but a glass of wine, and he is presently refreshed, a calm serenity of mind and new vigour as it were returns upon him. The brisk spritely sorts, such as champaign, &c. have this quality, but the spirits soon flag again after them; the austere wines, by having their spirituous parts more firmly fixed as it were, apply it to the body with a more lasting effect: by their astringent quality at the same time they strengthen the weak fibres more, and in this case are therefore to be preferred. These wines are given with the best success, if a little biscuit soaked in them be taken every three hours, for thus the virtue of the wine does not soon pass off, but gives new life as it were to the *primæ viæ*, when flaccid. *In bread and wine there is both strength and virtue (n).*

In a small quantity.] Errors are very often committed here, by making too much haste to repair these very weak bodies. The giving too much at once will oppress rather than relieve. What anxiety ensues, when in a phthisis the patient takes a little too much, though it be of the best nourishment, and thereby overloads his weak lungs with new chyle! the wise
appoint-

(n) Homer. Iliad. Lib. IX. circa finem,

appointment of nature requires, that tender infants should suck down their mother's milk often, but in small quantities. If this rule be not observed, every thing else, though otherwise the most proper, will avail nothing.

2. Among the causes assigned for the too great weakness of the fibres, one was too weak an application of the parts to one another. This was cured by making the solids act more strongly on their contained fluids; for every thing in the body depends on the mutual action and re-action of the solids on the fluids. Now this action and re-action is restored

By friction.] Which is in a manner the alternate pressure and relaxation of the parts of the body. Gentle friction presses the veins only, whereas a stronger presses also the arteries. By pressing the veins it accelerates the motion of the venal blood towards the heart; and by this means the motion of the heart is quickened, and of course the blood is propelled with a greater velocity through all the vessels. The vital powers may be increased therefore by friction to any degree, without any foreign addition to the body. For a burning fever may be kindled by friction in the coldest hydropical person. In those bodies where none of the viscera destined to form the chyle discharge their office through a state of inactivity, the rubbing the abdomen with coarse woollen cloaths in a morning fasting has wrought wonderful effects. And for this reason the Antients set a high value upon frictions, both as a preservative of health, and serviceable in the cure of many diseases.

If a horse be suffered to stand in the stable without dressing, in a few days he will become useless; but if his skin be curried daily with an iron comb, and rubbed with the brush, he will continue active for many years.

(o) *Nec minus, says Columella, quotidie corpora pecudum quam hominum defricanda sunt: ac sæpe plus prodest pressa*

F 2

(o) De Re Rustica, Lib. VI. cap. 30. pag. 597.

pressa manu subegisse terga, quam si largissime cibos præbeas; “ The bodies of cattle ought to be rubbed
“ down daily, as well as the bodies of men; and of-
“ tentimes it does them more good to have their
“ backs well rubbed down, than their bellies filled
“ with large quantities of provender.”

The frictions of the Ancients were of several kinds, and designed often to serve quite opposite purposes. And thus Hippocrates has said (p), *frictio potest solvere, ligare, carne implere, minuere, dura ligare, mollis solvere, multa minuere, moderata densare*; “ That friction
“ may loosen, or bind, may make plump, or lean;
“ if hard it binds, if soft it loosens, if violent it diminishes, if moderate it fills up.” For if a part be rubbed with soft oily substances it becomes more lax.

But in curing weak fibres the best kind of friction is that which is made warm with rough woollen cloths, especially after they have imbibed the vapour of burning amber, mastick, &c. that the aromattick strengthening steam may at the same time insinuate itself into the laxer parts. But here we must proceed by degrees, and not use the strongest frictions immediately; lest the mass which stagnates in the too distended vessels, being pressed towards the heart in too large a quantity, should overwhelm and suffocate it: or lest the yet too tender vessels should break by the too imprudent increase of motion.

Riding on horseback.] The pendulous viscera of the abdomen, nay and of the breast too, are by this means shaken every moment, and gently rubbed as it were one against another, while in the mean time the pure air acts on the lungs with greater force, all which conspiring together cause incredible changes. But it is to be observed, that a weak man should not ride on a full stomach, but either before dinner, or after the digestion is near finished; for when the stomach is distended, weak people do not bear these concussions of the horse without difficulty; but when the *primæ viæ* are

(p) De medici officin. Charter. Tom. XII. pag. 94.

are near empty, the remaining fæces are discharged by this concussion.

Sydenham had so high an opinion of riding (q), that he believed by this alone he could cure a consumption, provided it was not quite desperate; or when the diarrhoea, so fatal in this case, was not yet joined to the night-sweats; nor did he judge mercury to be more effectual in the cure of the lues venerea, or the Peruvian bark in intermittent fevers, than riding in the cure of a consumption.

But he advises that the patient should not fatigue himself with violent riding at first setting off, or all at once, but increase his journies and his speed by degrees; and in the same place produces some extraordinary instances of cures wrought by this means.

He then adds, that though riding on horseback be most beneficial to phthical people, yet that travelling in a coach has also wrought surprising effects.

For this reason, those that are too weak to support themselves on horseback, should be carried in a coach 'till they have strength enough to bear riding. In all ages carrying in arms and rocking in a cradle have been found of service to infants, who are the weakest of our species.

Sailing in a ship is also of use to weak people. If the vessel moves with an even motion, by increasing perspiration it usually excites a wonderful alacrity, creates an appetite, and promotes digestion. But to be tossed on a stormy sea affects the strongest man not used to it with giddiness, vomiting, intolerable anxiety, and even fainting; insomuch that it has happened sometimes accidentally to have proved a cure of inveterate diseases; but such violent commotions raised in the body would by no means suit with weak people.

These exercises are all of them more especially serviceable to weak people, as they hereby enjoy the benefit of motion without much fatigue. But as soon as

(q) In Dissertatione Epistolari, pag. 523, 524.

the strength begins by this means to return, the body is farther to be corroborated by muscular motion.

And this is to be brought about by walking, running, and bodily exercises.] For unless such persons as have been thus indisposed, will habituate themselves to this kind of exercise, they will fall back by degrees into their former calamity : this is what we so frequently lament in practice. If girls that have been cured of a languid chlorosis are still too fond of a sedentary life, and do not take care to keep up their strength by bodily exercise, they will within a few weeks become as weak and pale as before. They may expect to receive proper nourishment from their food though they live idle ; but in such a way it is impossible they should ever breed good blood, or that the same slothful and indolent ill habit should not return. *Cibi enim & labores*, says Hippocrates (r), *adversas inter se potestates, mutuo tamen ad sanitatem conferentes, habent, labores namque ea quæ adsunt solent consumere, cibi vero & potus quæ vacuata sunt, replere* ; “ For food and exercise have opposite effects, yet mutually contribute to health ; exercise consumes what “ is in the body, and meat and drink fill up the deficiency.”

But how far muscular motion may contribute to strengthen a weak body, has been observed Numb. 2. Sect. 15.

In these exercises we must begin with the most gentle, such as walking, and increase it by degrees 'till we come to running. Those exercises of the body are more especially serviceable, which give delight to the mind at the same time, as tennis, fencing, &c. for which reason the wisdom of antiquity appointed rewards for those who excelled in these gymnastick exercises, that by this means the bodies of their youth might be hardened for warlike toils. Cyrus made it in a manner a law to the Persians, whose good education

(r) Hippocrat. de vict. rationem sanorum, Lib. I. cap. 2. Charter. Tom. VI. pag. 448.

tion was always a great part of his care, that they should never eat but after labour (s).

3. This advice is of the greatest moment, as diseases which have been thought desperate have often been cured by a gentle compression of the vessels only; this should never be so great as by making the opposite sides meet to destroy the cavity of the vessels, for in this case the life of the part would be destroyed too, but only to draw them into a narrower compass than they would have had without this compression. For by this means the vessels which are too weak will be prevented from being too much distended by the fluids contained in them: for the capacity of a vessel depends not upon its distending liquid only, but upon the excess of its distending power above the resistance of the vessel: but the more a fibre is distended, the more it is weakened; whatever therefore hinders the stretching out of the fibre, removes the cause which weakens it. Now bandages, or cloths drawn tight to the body, supply the vessels with that support, which the solids were too weak to do, that is, they hinder the too great dilatation.

The cure of some diseases shall be more promoted by this means, than by all other means whatsoever. In ananasarcous dropsy, where the legs and thighs are swollen to a great degree, if either by accident or design a rupture is made in the skin, though the water be thereby carried off, yet the parts will remain flaccid and pendulous, and unless you strengthen them by proper bandages, they will soon swell again.

When the water collected in an ascites is drawn off by tapping, if care be not taken to gird the belly tight with a proper roller, either a fatal syncope shall in an instant carry off the patient, which has frequently been the case, or the lax and pendulous parts shall fill again, and all the dreadful symptoms of the dropsy presently return.

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When the liquids stagnate in the dilated vessels of the thighs, or at least move more slowly through them than they ought, which is more especially the case in a scorbutick habit, there frequently follow from a meer scratch of the skin such malignant ulcers as shall often refuse to yield to the properest applications, and yet a bandage drawn so tight as by compressing the parts to prevent the stagnation of the liquids, has often proved of great advantage.

I remember I once had under my care a young lady of distinction, who was more continually in motion than any nervous person I had ever attended. The least noise in the world, or the letting in upon her too strong a light, would straight throw her into convulsions, the abdomen at the same time being drawn into a variety of strange motions, and feeling as if it was rending asunder. Neither the ferulaceous juices, nor the powerful virtue of castor, so serviceable in nervous complaints, were here of benefit; but when her legs, thighs, and the whole abdomen, were bound round with proper bandages, this troublesome disorder presently abated, and then by the use of proper remedies she recovered. Thus she lived for several months wrapped up like an Egyptian mummy, and by no means to her dissatisfaction, as she presently found so much relief from the application.

4. Hitherto we have described the cure of too great weakness in a simple solid fibre, so far as it is to be had from the use of the non-naturals, and surgery, or the application of bandages. It now remains that we point out such medicines as taken internally, and left to the powers of nature, will make such a change as is required to produce health. The disease was owing to the too weak cohesion of the elementary particles of the fibres. Such remedies must therefore be sought for, as when applied to the body will make their cohesion firmer; and such as these we may be supplied with from the materia medica.

Medicines

Medicines both acid and austere,] which are called astringents. These when they are applied to the tongue, do all exert their power very manifestly; the mouth itself is rendered dry by their closing up the orifices of the vessels, from whence it is supplied with moisture, the tongue is contracted, as it were, and made shorter. For which reason Galen has said (*t*), *Gustus solius proprium est discernere, quod vim astringendi habet*; "It is peculiar to the taste to distinguish what has an "astringent power." In all these medicines there seems to be this peculiar property, that when applied to the parts of the body they draw the elementary particles of the fibres in a manner nearer to each other, and induce them to cohere more firmly: nor will this effect cease to follow, though they be applied to the parts even of animals. Thus when the tanners have by long maceration separated the adhering fat from the hides of animals, and softened them almost to a degree of liquefaction, by adding to them these austere ingredients they shall restore them to their due strength again; this is what Pliny terms *coria perficere*, where (*u*) speaking of the pomegranate, he says, *Corticis major usus ex acerbis ad perficienda coria*; "The "bark is chiefly used for its acerbity to give the last "degree of perfection to leather." At this time of day oak-bark, which is much cheaper, is made use of for this purpose. A catalogue of the principal vegetables which have this virtue are to be found in the *materia medica*.

Among the acid austere fossils, steel dissolved in a fermented vegetable acid is preferable to all others, by means whereof such persons as labour under a cold, weak, tumid habit, shall recover even to a miracle. It causes no evacuation of the distending liquid, but adds new strength to the solid vessels, where by being more contracted they drive forward the almost stagnating fluids; whereas were we to attempt to cure these

(*t*) Meth. Med. Lib. VIII. cap. 2. Charter. Tom. X. pag. 184.

(*u*) Lib. XIII. cap. 19.

these diseases by evacuations, we should only increase the weakness.

For the use of these preparations an agreeable warmth is found to diffuse itself through every part of the body ; the bloated parts subside, the paleness of the lips and cheeks is changed into a florid sanguine complexion ; the dulness, indolence, and difficulty of breathing upon every the least motion, cease ; the former activity returns, all the functions are properly discharged, and life is in a manner renewed.

The same effect is produced by the steel dissolved in the medicated Spaw-waters.

Or such as are spirituous and well fermented.] If pure alcohol be mixed with the serum of the blood, or the white of an egg, it presently coagulates them. If the solid parts of animals be kept in alcohol, they grow much harder, and are contracted in every dimension. There certainly is therefore in alcohol the power of shortening the solids of animals ; but then at the same time it coagulates the humours too. For which reason we ought to use the utmost caution, in giving fermented spirits, for they are capable of producing abundance of mischief, both as they inspissate the liquids and contract the solids, if used imprudently. In the dead body of a woman addicted to drinking, the spleen, pancreas, liver, and lungs, were all found dry, schirrhous, and in a manner partly petrified ; all the glands internal and external were become very near as hard as stones (*w*). And many other examples of a like nature are to be found in the observations of other authors.

Prudently and gently, &c.] For all these, when given internally, act first upon the stomach and intestines, and can never enter the blood with their powers entire, for then they would do mischief ; they ought to be given therefore in small quantities, often repeated, that so they may gradually enter into the blood after being first diluted by the humours. If a few grains only
of

(*w*) Académ. des sciences, l'ann. 1706. Hist. pag. 29.

of the most acerb juice of the Egyptian acacia be held in the mouth, it causes a general contraction, and so ties up the orifices of all the vessels on the inside of the mouth, that in half a quarter of an hour it becomes perfectly dry; should this therefore be applied to the most tender orifices of the lacteals, it would intercept its own passage by closing them. But as these all act, first on the *primæ viæ*, and cannot enter the mouths of the lacteals 'till they are greatly diluted, and so insinuate themselves by stealth, as it were, into the blood: for this reason they cannot arrive at the last stage of the circulation but with their powers very much diminished. To this purpose Galen has well observed (x), *Quocirca medicamenti, sive id foras applicatum, sive ex illis fuerit, quæ devorantur vel potantur, potestatem præsentem non oportet considerare, sed qualem habebit, ubi ad affectum locum pervenerit*; "That it is not sufficient to consider the present power of a medicine, whether externally or internally given, either by a liquid or solid form, but what its power will be when it comes to the part affected."

These acid austere medicines, however, especially those of the stronger sort, if they are given imprudently, may produce very sad diseases, partly by coagulating the liquids, and partly by closing up the mouths of the very small vessels, which are spread over the internal surface of the stomach and intestines.

For which reason steel dissolved in the milder acids is commonly preferred to all others, because it acts not only by its austere astringent virtue, but because by the wonderful stimulus of its metallick sulphur, which is so friendly to our nature, it raises the vital powers.

5. Distention has a tendency to withdraw the elementary particles of the fibres from their mutual contact; and of course to dispose them not to cohere at all, *i. e.* to break. That condition which approaches nearest

(x) De Meth. Med. ad Glauco. Lib. II. cap. 4. Charter. Tom. X. pag. 375.

nearest to a rupture is the weakest degree of cohesion, or the cohesion which is capable of being destroyed by the least additional force; whatever therefore draws the elementary particles asunder, makes the fibre weak by lessening its cohesion. When the string of a musical instrument is strained by a weight hung to it, it is made longer, increase the weight and it grows longer still, 'till at last it breaks. The moment, however, before it broke it still cohered, though so little, that with the addition of a very little more weight it was liable to be broken: now the way to increase the strength of the chord, whilst in this state, was to take away the weight that strained it.

The case is the same with regard to our fibres: for as the distending causes lessen, the strength of the fibres increases almost every moment, from the natural tendency they have to contract themselves. Of this we have many very plain instances in diseased persons. In a case where the œsophagus was so oppressed by a schirrhus humour gradually increasing, that in the last months of a miserable life, the patient could swallow nothing but a few drops of milk diluted with water, or thin broth, and that not without the greatest difficulty. When the body came to be opened, I observed the capacity of the stomach did not exceed the size of one of the small guts: for as the stomach had not been distended at all for so many weeks, its fibres had contracted themselves into this narrow compass.

This wonderful property obtains in all the solid parts of our body, that if they continue long in the same contact, they shall so cohere as not to be separated after.

If a man be confined to his bed for a broken leg, and the Surgeon does not take frequent care to bend his joints gently, upon his recovery those articulations shall be all immoveable: for the ligaments not having been distended for many weeks together will become hard and stiff.

S E C T. XXIX.

A Fibre is said to be *lax*, when its parts do so cohere (21) together, as by the application of a very small fibre it may become longer than it was before; it is plain therefore that this is a kind of weakness (24), and that *flexility* depends upon it; that these therefore and also the *lessened elasticity* of a fibre may clearly be understood from what has been said (21, 22, 23, 24, 25, 26, 27, 28.) For even glass, which is a very brittle body, when drawn by art into threads, which are finer than those of a spider's web, does still cohere, and may be bent every way with very little force into a great variety of foldings without breaking; its flexibility increasing in proportion to its fineness. *Ac. reg. sci.* 1713. *hist.* 11,

Laxity.] The fibres were said to be too weak, when they were unable to sustain that force, which necessarily arose from the discharge of the functions in a state of health, without losing their cohesion; or though they could sustain the powers of perfect health, were yet liable to be broken by the least increase of motion, which in the course of human life was unavoidable. Now by too great a laxity of the fibres is to be understood that state, wherein though they cannot bear the force of vital motion without losing their cohesion, yet if they be stretched or pulled out by any small force, they shall by this means become longer than they were before.

A thread of silk that is unable to sustain a weight that is hung to it without breaking, gives us an idea of a fibre too weak; a line made of very soft lead, drawn out into a very great length by the application
of

of a like weight without breaking easily, gives us a true image of a fibre that is too lax.

On the due laxity of the fibre however depends their

Flexility.] For that every office should be discharged in the body, which is daily observed to be wrought by the motion of the humours, vessels, and muscles, the elementary fibres of the solid parts must in some measure depart from their contact, and in some measure persist in it, in order hereby to admit of elongation. For instance, there could be no bending of the joints, unless the ligaments by which they are tied, were capable of being lengthened. For which reason there is a certain degree of laxity requisite to health, which when it is increased becomes a disease.

Lessened elasticity.] The elasticity of the fibres consists in this, that they are capable of being extended, and when the extending power is removed return to their former length.

But this power consists only in the effort wherewith the smallest constituent particles of a fibre attract each other, when made more distant by the lengthening of the superficies, without a rupture of their cohesion. If therefore by any cause a fibre is made so weak that its parts attract each other with too little force, its elasticity is of course diminished.

Our greater vessels are composed of smaller ones, and these of much smaller still, nor has anatomy hitherto discovered where they terminate. The muscles consist of smaller muscles, and that which to the naked eye appears a muscular fibre, when examined by a microscope shews itself to be a bundle of lesser fibres.

The same is observed of the nerves, &c. so that all the parts of the body seem to consist of infinitely small similar parts: this was indeed no more than requisite to produce their flexibility; for in the instance produced above it appears that glass, the most brittle
of

of all bodies, may be made so ductile by merely dividing it into very fine threads, that the ingenious Monsieur Reaumeur did not doubt but that it might one day fall under the workmanship of a weaver (a). I have myself seen false hair made of glass drawn into threads, that would admit of being curled without breaking.

S E C T. XXX.

THE same principles also furnish us with an easy answer to the following questions : why watery and fat aliments cause a weakness in the fibres ? why the fibres are weak in persons that are of a cold constitution, that are youthful, use no exercise, and are still growing ? why earthy and austere substances give strength to the fibres ? why the fibres are strong in persons who are of a hot constitution and given to much exercise ? why proportioned elasticity of the fibres is joined with their strength ?

Why watery and fat aliments, &c.] This we learn from experiment. For the hardest parts of animals, if soaked in warm water, especially if exposed to the vapour of it, will become very soft. Old stags horns, from hanging in the vapour of warm or boiling water, will grow soft enough to be cut with a knife, as we see in that medicine which is called the philosophical preparation of hartshorn.

To how weak and flaccid a state do those young women reduce themselves, who are accustomed to a daily habit of drinking warm aqueous liquids ? In that book of the use of liquids which are ascribed to Hippocrates, the following mischiefs are assigned as the conse-

(a) Acad. des sciences, l'ann. 1713. Mem. pag. 279.

consequences of drinking warm water too freely (a), *Carnium effæminationem, nervorum impotentiam, mentis stuporem, hæmorrhagias, animi deliquia*; "Tendernefs
" of the flesh, weaknefs of nerves, stupor of the mind,
" hæmorrhages, and faintings."

The weaknefs of a fibre confifts in fuch a cohesion of its parts, as may eafily be feparated; but the elementary parts of water cohere very flightly; for which reafon poffibly if two or three of the particles of water be interpoſed between the elementary parts of the fibres, the fibre ſeems to be made weaker thereby; whereas if a fingle particle only were between them, it would be much the ſtronger for it: for the elementary particles of water confidered in themſelves ſeem to be perfectly hard and immutable, and capable of coaleſcing with other bodies in a wonderful manner, as has been ſhewn in the explication of §. 21. And hence perhaps the reafon may be deduced why the parts of animals when ſoaked in water ſhall become the ſofter: but when dried again ſhall be much ſtiffer than before. For we learn from experiments, that water is capable of inſinuating itſelf between the elementary particles of bodies and removing them from their contact. Shreds of paper ſteeped in water become longer by almoſt a fixth part (b).

That oily ſubſtance will for the ſame reafon ſoften the ſolid parts, appears from abundance of experiments. The ſtiffeſt hides of animals, when ſoaked in oil, will become ſoft; the muſcles, in order to retain their due flexibility, are covered over with oily caſes; ligaments are lubricated with the medullary oil attenuated, that they may not grow ſtiff. And when this oil begins to fail, as in very old age, how very hard do they become! In fat bodies, where this oil too much abounds, how greatly relaxed and tumid is the whole weakly compoſition?

Why

(a) Cap. 2. Charter, Tom. VI. pag. 444. & Aph. 16. Sect. 5. Charter, Tom. XI. pag. 203.

(b) Académ. des ſciences, l'ann. 1714. Mem. pag. 72.

Why in persons that are cold.] We here mean persons that are of a cold constitution. For cold, absolutely considered, induces strength by drawing the elementary particles nearer to each other; but in persons of a cold constitution, the circulation is weaker, the blood is less compressed, the crude aliment is not much changed, and the minute elementary particles are applied to each other with less force, and from hence follows a lesser cohesion.

That are youthful.] The human embryo, in its first formation, is no more than an exceeding small speck. Afterwards, when it is grown larger, so as to come within the notice of the senses, it would fall together like a mucus, if it were not sustained by the equable pressure of the surrounding liquid. The infant, when it is just born, is quite soft and pulpy, with bones that are still flexible; as it grows older it grows firmer by degrees. The nearer therefore a man is to his original, the softer are all his parts. For which reason, though his fibres have a firmness suitable to his age, yet they may be called weak, if compared with the fibres of an adult. But this was requisite that the human body might admit of being extended in every dimension during its growth from so very small to so large a bulk.

Who use no exercise.] See §. 25. numb. 2. When girls are cured of their languid diseases by the salutary use of steel, and neglect to use exercise, how soon do they relapse into their former weakness! Hippocrates enjoined labour to such persons as languished under a dropsy; but to such as were afflicted with acute diseases he ordered absolute rest: for in the latter case, the active powers of life being raised too high by the fever, tended to consume all the liquids, and make the solids perfectly dry. For which reason, the whole cure almost of acute diseases consists in bringing on a disposition towards a dropsy; that is, reducing the patient to a greater degree of weakness.

Who are growing.] The humours being impelled through full conical vessels from the *basis* towards the *apex*, do constantly endeavour to lengthen the sides of their canals in the direction of their longitudinal axis. As long therefore as the canals give way and admit of being lengthened by this force, a man grows. For which reason a less firm cohesion was requisite that they might give way. But we see the quickest growth approaches nearest to the first formation of the man, in which periods the solids are scarce capable of making any resistance; for in the space of nine months, he grows from an imperceptible stamen to a bulk that shall weigh sixteen, sometimes twenty, pounds.

We farther see sometimes, that a fever happening to a young person before he has attained his full growth, shall stretch out the vessels which are yet capable of being easily lengthened, and make a very sensible addition to his stature. A less firm cohesion of fibres therefore was required to his increase, that they might give way. When therefore the bodies of young people are too much hardened by violent labour, their growth is stopped before its time. And for this cause it probably is, that such persons as breed up lap-dogs for the ladies, who generally like the smallest best, give them brandy or wine every day while they are young, to stop their growth.

Why earthy and austere substances.] Of austere substances we have spoken already, §. 24. numb. 4. These bodies seem from experiments to be endued with a certain power of drawing the elementary particles of our fibres nearer to each other. But the nature of earthy bibulous bodies is, to attract all the liquids that they can touch, and then to form with them the strongest concretions. A tobacco-pipe just baked and not glazed, as soon as it touches the lips, will stick so very fast that it can scarce be taken away without hurting them. Since therefore watery substances debilitate the fibres, as appears from what was said before, those

those substances which absorb water, are to be reckoned among the strengtheners.

Why to persons that are hot.] External heat applied to the body universally weakens it: for it sets the elementary particles of the fibres at a greater distance, and so makes the fibres weaker. But here we more particularly mean persons of a hot constitution, in whom the dense and compacted humours are impelled through the vessels with a very violent motion; in these persons the assimilating faculties are always strong, and the application of the elementary particles of the fibres to each other very powerful. On which circumstances the strength of the fibres depends.

Daily experience teaches us the difference there is between heat got by exercise, and that of the fire-side. He that guards against the winter's cold by sitting near the fire, rises from it dull and heavy; whilst he that gets the better of it by strong bodily motion, is always lightsome and active.

And given to much exercise.] Of this we have treated § 25. numb. 2. The countryman who provides bread for himself and family by hard labour, is firm and robust in every part, he despises all the inclemencies of weather, feeds on the hardest fare, and digests it perfectly well: while the man who gives himself up to luxury and idleness, spends his days in weakness and misery. He is sensible of every the least change of weather, and is scarce able to swallow down a morsel, though provoked to it by numberless appliances, which, fulness and not hunger, has invented, to create an appetite.

Why elasticity, &c.] Those bodies are termed elastick, which upon being distended return again into the same points of contact they were in before; there is a strong power requisite therefore by which the parts that are thus distended must attract each other; and in this power consists the strength of the fibres.

The following example may illustrate this matter. If two magnets touch one another they will cohere : if they are removed from each other to a small distance, yet not so far but that they can still act one upon another, they will come together again : so likewise the parts of an elastick body when stretched out will attract one another again, as soon as the distending force is removed, and continue to cohere as before. Press the flesh of a weakly leucophlegmatick wench with your finger, and it will pit like dough, and rise again but very slowly, if at all ; do the same thing to a strong man, and the part will soon be restored to its former state by its elasticity.

Thus have we given a description of the most simple disease, and laid down a rule, how to find out the nature of it ; we have then proceeded to point out the particular causes to which it is owing, and have likewise shewn the præternatural effects, which are apt to follow upon it ; and how from these we may form a prognostick of the future events ; as also by what means, from the diagnostick signs of the disease, an indication may be obtained, sufficient to direct the Physician in what manner, and by what instruments, he may effect a cure ; and after this have drawn some general corollaries from the whole.

It seldom happens, indeed, that the case of weakness in a simple solid fibre comes alone, without being attended with many other disorders. It was requisite however to consider it thus abstractedly, in order to give a clear notion of it ; and for this reason we introduced a man in perfect health, whose fibres we supposed of a sudden grown too weak from any intervening cause whatsoever.

The DISEASES of a stiff and elastick FIBRE.

S E C T. XXXI.

THE too great stiffness of a fibre is the joining together of its smallest particles in such manner (21), as shall cause them to cohere so closely, that they shall not yield to that action of the fluids, which ought to overcome this resistance, in order to preserve health.

Our life and health depend entirely on this, that all the fibres in every artery should be so plyable as to admit of being distended by the blood, that is, expelled by the muscular power of the heart to such a degree, as to be able to receive the blood that is thus expelled. For while the heart is in its diastole, the arteries and veins are full, else there would be no continued propulsion of the blood. The next moment in its systole the heart throws out the blood into the full arteries, and through those into the veins which are also full: if these vessels therefore should resist being dilated with an infinite force, and the blood were not compressible as it is, the heat could not be evacuated, as life would cease. Such a laxity therefore is required in the fibres which constitute these vessels, as that they may yield to the distending blood expelled from the heart into these full vessels. Now the more rigid these fibres are, the greater is their resistance.

For this reason, as we observed also of a weak fibre, no absolute definition can be given of a too rigid fibre, but such only as is relative to the different age of the subject, &c. thus that the little heart of a small embryo may suffice to dilate the vessels by the

blood propelled from it, no greater cohesion is required, than that all the solids should resemble a mucus.

S E C T. XXXII.

THIS (31) will follow from all those causes which are necessary to the cure of a weak fibre (28) if persisted in too long, and too frequently applied.

We have premised the account of a too weak fibre, as the cure of this disease lets us into the knowledge of the causes why a fibre is too rigid. Whatever therefore relates to the cure of a fibre that is too weak might be here repeated, but one example shall suffice.

Moderate labour strengthens the body; excessive labour dries it, and makes every part of it too stiff. Country-fellows, who are obliged from their childhood to violent exercise and excessive labour, often die at forty, of a like marasmus with that which is incident to old men, having their juices all exhausted, and their solids too rigid, and becoming decrepid before their time.

S E C T. XXXIII.

THIS disease (31), wherever it is present, causes the vessels, which consist of these fibres, to be less flexible, narrower, and shorter, and liable to resist too much the motion of the liquids passing through them, with all the consequences following hereon; see (50, 51, 52, 53.)

Our vessels always resist distention; for which reason their capacity depends on the excess of the distending

stending powers above this disposition to contract. When therefore the contractile power of the vessels is increased, and the distending power remains the same, the vessels will be the more contracted, that is, they will become narrower. The last degree of this disease is, when the vessels will not yield in the least to the distending liquids; hereby the motion of the blood is presently stopped, and that most gentle old-man's death ensues, when every fibre, being grown stiff through extremity of age, does not give way to the impelled fluids. If the liquids be diminished by any cause whatsoever, the strength of the vessels reduces them to so narrow a compass, that though they still continue full, they are notwithstanding much less distended.

A man may lose half his weight by an acute continual fever in fourteen days, his vessels contracting as the quantity of liquids diminishes. This clearly appears, as all animals have their vessels so much the more contracted, as the strength of their fibres is increased.

If an horse standing in the stable be plentifully fed, and thereupon growing fat, be taken thence, and gradually rode hard, so as to lose, perhaps, a third part of his weight, he shall, notwithstanding, be more strong to labour, and the fibres of his vessels being hereby consolidated, though he afterwards stand idle in the stable again, yet he shall not become fat again so soon.

Shorter.] The force of a liquid impelled through flexible conical canals tends to lengthen those canals; and by this means they are lengthened as far as the cohesion of the fibres will admit, as we learn from the remarkable growth of young people after an acute disease. I remember to have seen, upon the cutting off of a great toe, at one stroke, with a sharp instrument, that two of the arteries were extended beyond the level surface of the wounded part to the length almost of a geometrical line: to such a degree were

these vessels lengthened in a situation so remote from the heart. But when the fibres are grown too stiff, they will not admit of being thus lengthened; on the contrary, as the strength of the fibres prevails, they shall become shorter. This we see in old men, who in reality grow shorter than they once were.

The motion of the liquids, &c.] When the heart propels the blood through the arteries, part of the force communicated from the heart is spent in dilating the arteries, whilst the remaining part propels the blood through the arteries. If therefore the arteries become less dilatable, *i. e.* more rigid, more of the motion communicated by the heart must be spent in dilating them, and less in propelling the blood. And from hence the reason is plain, why fibres too rigid increase the resistance given to the motion of the liquids.

But every office in the human body depends on the due motion of the humours through the vessels; so that infinite mischiefs may arise from this simple cause, of which more hereafter in the numbers cited.

S E C T. XXXIV.

FROM which (31, 32, 33) this disease (31) is capable of being known, its future effects likewise of being foreseen (33), nor is the method of cure, which it requires, less evident.

From the three preceding sections we may easily collect the diagnostick signs of a too great stiffness in the fibres. If, for instance, we see a person lean, with the inside of his mouth and jaws drier than ordinary, little or no moisture upon the skin, and a more than usual stiffness in his joints, and this notwithstanding he takes down a sufficient quantity of nourishment, we conclude that the solids are too firm and powerful for the liquids, and pass them off too hastily. These

men are at the same time lean and voracious ; as they very soon digest whatever they take down and throw it presently off.

Now if we know that such food and medicines have been administered as were enumerated in the cure of too weak a fibre, we foresee that this disease of too great stiffness is likely to follow.

And according as this too great stiffness happens in a single part, or in the whole body, very different and surprising diseases will ensue ; for we learn from experience, that all the known canals of our body are capable of growing stiff, and oftentimes from such minute causes, as can by no means be discovered.

Thus sometimes a finger, sometimes the whole arm, shall by degrees decay and become dry : for if the resistance of the vessels be increased from any cause whatsoever, the extension of them will be less, and of course a very slow marasmus ensue. I have seen a woman not forty years old, whose body in two years time has been so wasted with a lingering marasmus, as to leave nothing behind but a squalid skin to cover her bones, and this without any visible defect in the frame of the body, or any suspicion of an internal suppuration, or the increase of any sensible evacuation. Possibly they were such distempers as these, which the antient Physicians called *ἐκ νόσου γῆρας*, (a) *old age arising from disease*.

Santorini (b) tells us in his very accurate anatomical observations, that as he was examining the body of a man, whose right eye had been long subject to a true amaurosis, he found the optick nerve of that side smaller than in a natural state, and of a darker colour. In this case possibly there may have been too great a rigidity in the right optick nerve from some secret cause. And if the like circumstance happens in the other organs of sense, or in the viscera, different diseases may follow without number.

From

(a) Galen. Method. Med. Lib. VII. cap. 6. Charter. Tom. X. pag. 167.

(b) Cap. 3. §. 14. pag. 64.

From these observations duly considered the proper means of removing the too great rigidity of the fibres are easy to be discovered, and are enumerated in the following section.

S E C T. XXXV.

FOR this is obtained 1. By a thin watery diet, especially whey, very soft herbs, mealy substances diluted and unfermented. 2. By indulging rest in a moist cool air, and long sleep. 3. By aqueous medicines both externally applied and inwardly given in a lukewarm state, by the administration also of such as are insipid, and are of a most smooth, soft, and oily, nature.

1. By a thin watery diet.] We call that drink watery, which consists either of pure water itself, or in which water predominates. We call that food watery, which is principally made up of water, such as gruels, broths, and the like. If these be internally given, they supply the parts within with a considerable quantity of water, convey it through all the vessels, and thereby soften and lubricate every part; for the property peculiarly belonging to water, especially if warm, is to soften the hardest parts of an animal body: for we can make their horns, nails, nay even their very bones, soft with warm water.

For this reason we see, that in all those nations, which live in the hottest climates, and have the leanest bodies, their appetite leads them scarce to any thing else but water and watery food. Nor should it seem strange, that whey is here recommended, because milk has before been said to be very serviceable towards strengthening the fibres when too weak: for in whey there is none of the subtle spirituous substance, none of the substance which coagulates into cheese, nor any thing indeed left remaining but the watery
part

part enriched with the dissolving virtue of the grass. Butter-milk more especially deserves to be commended in this case, as it has none of the fatness whereof the butter consists, and is somewhat acidulated, and consequently of so great a service in acute diseases. Under this head we may likewise bring all the juices of the summer-fruits, when thoroughly ripened.

Very soft herbs.] These are all enumerated in the *materia medica* of the celebrated author. They have none of them either any considerable smell or taste, but rather consist of a watery and most emollient mucilage. And for this reason broths made of these are so very salutary in atribilarious cases.

Mealy substances diluted.] In very dry bodies, where the humours are always dense and compact, the water that is drank soon passes off, and makes but a short stay in the body. This is frequently the unhappy case in acute diseases, wherein the water taken down presently runs off by sweat or urine. To the water therefore must be added the mealy substances described in the *materia medica* with this intention, that the water by means of this mealy lentor may adhere the more as it were, and not be so soon driven out of the body. This seems to have been the reason why Hippocrates condemns the use of water in acute diseases (a), though in the same book he commends highly the use of a ptisan. These mealy substances give a lentor to the water, and by the oil, that lies wrapt up in them, which will mix with water, and may be expressed pure out of them, prove universal emollients. It is certain, that water-gruel only, drank daily in a large quantity, will so far enfeeble the strongest man, as to bring upon him a general languor. This the country people are so well acquainted with, that they will fat their hogs with meal alone mingled with water or skimmed milk.

In this country many of the common people who sit to work, which is not very laborious, and at the
same

(a) De viâ Acutor. Morbor. Charter. Tom. XI. pag. 102.

same time live almost wholly upon mealy substances, have their bodies constantly in a lax state.

And unfermented.] The same observation will hold good of the juices of the summer-fruits; for fermented spirituous liquors were justly reckoned among the remedies of a weak fibre. For from all these are spirituous liquors capable of being produced by fermentation, which when raised to the highest degree will burn up all the solids of the body almost like fire, and condense the blood into grumous clods, which cannot again be dissolved.

2. By rest, &c.] Muscular motion was reckoned the principal remedy in curing a fibre when too weak; no wonder therefore if rest produces the same effect. They who would most speedily fatten animals keep them constantly free from motion, and at the same time feed them to the full. For which reason, in acute diseases, where all is dried up, the antient Physicians enjoined absolute rest, and especially in an air disposed to be cool and moist: for a cold and dry air strengthens the fibres.

But nothing relaxes the body more than the warmth of a bed or longer sleep than ordinary; for in this case the patient lies in a bath of vapours exhaled from his own body. For which reason all animals are turgid after sleep. And Hippocrates therefore said (b), *Longiores verò somni calefacientes colliquant carnem, & corpus diffundendo resolvunt, & imbecillum reddunt*; "That long sleep by its warmth dissolves the flesh, and by its diffusing quality resolves and weakens the whole body."

And in another place (c); *In quibuscunque morbis siccitas confert, conducit quàm minimum dormire. Quibus verò humiditas confert, non debent enidiam pati, nec cibo aut potu indigere, neque laborare, & dormire quantum volent*;

(b) De victu ratione Sanorum, Lib. II. cap. 10. Charter. Tom. VI. pag. 474. (c) De affectionibus, cap. 12. Charter. Tom. VII. pag. 632.

volent; "In all diseases where dryness is of service, it is adviseable to sleep very little. But where moisture is required, the patient should not be exposed to hunger, want meat or drink, or use exercise, but sleep as much as he pleases."

3. The principal of these, and the basis of all the rest, is water, which when warmed and turned into vapour, will so soften even the hardest parts of animals, as almost to throw them into a liquid state. In acute diseases, wherein the skin is frequently so very dry, as to carry nothing off by transpiration, the orifices of the vessels, through which we perspire, being quite closed up, it is to no purpose to endeavour to provoke a sweat by warm medicines: but if the body be exposed naked to the vapour of warm water, the mouths of the vessels will uncloze, the skin grow moist, and a profuse sweat soon after ensue. But as in these diseases the internal parts are altogether as dry as the outward skin, it is usual to inject resembling clysters, and give thin decoctions of mealy substances in water, in order to soften all within; insomuch that when the body has been more weakened than it ought by these watery applications, an opposite evil, *i. e.* a dropsy, has thereby been produced.

These watery applications ought all to be made warm: for cold condenses and strengthens the fibres; and yet if given too hot they will coagulate the blood and burn up the solids into a gangrenous crust.

They ought all likewise to be given unsalted, for salts harden. as we see in salt flesh. At the same time we find very great relief from

Mild oily medicines.] It is well known that the hides of animals when steeped in water will grow flabby, but when dried shall become more stiff than they were before; these also if rubbed well with oil shall remain soft a considerable time; for oil sticks closer, and is not carried off so soon. When the fibres of the intestines are contracted by spasms, which cause such terrible excruciating pains, large draughts and

and clysters of very smooth oil, to the quantity of some pints, shall relax the fibres and remove the spasm.

In acute diseases, where a very great dryness and strength of the solids arise from the disease, or oftentimes pre-exists before it, these applications would be of excellent use, if the increase of heat did not corrupt the oils, which easily grow rancid, and turn their mildness into sharpness: in this case the decoctions of the mealy kind, enumerated in the *materia medica*, do well supply their place; for from all these, especially when dried, may be expressed a pure oil in a large quantity, which is not discernible in these decoctions, being so united to their mucilage, as to preserve the entire emollient virtue of the oil, without any danger of growing rancid.

When this disease of too great rigidity is fixed in some particular joint (for an anchylolis often happens by the ligaments being so hard as not to suffer the extension required to bend the joint) the most successful way of treating it is by rubbing well the part affected with a lixivium of soap, so as to make it perfectly clean and perspirable, and then several times a day exposing it to the vapour of warm water: at the same time the dried part must be anointed with very smooth oil; and the too rigid ligaments gently strained by bending the joint. For too violent a straining was assigned as one of the causes why a fibre may become too weak, and therefore after the forementioned applications it cannot but be highly serviceable to distend the too rigid parts.

The Antients, in order to restore an emaciated part to its former state, would irritate the parts affected 'till they brought on a slight inflammation and swelling; for by this means the humours being carried to the part with greater force and celerity, dilated the vessels that were before too narrow. And thus, by frequent repetition, the resistance of the coats of the vessels was so far diminished, as to yield to the humours

mours which naturally flowed into them, and the part rendered fleshy as before. Thus Galen, in a few days, cured many of his patients by rubbing the muscular parts with oily substances, who had long been consumptive and in a wasting condition (d).

Friction therefore is good in this case, but with some oily substance, and only so as to bring a light redness upon the part: for if you go farther, you discuss that which friction had invited into the part, a greater distension of the vessels, which were too stiff before, being all that is required here. This Galen carefully advises in the following words (e), *Ideoq̃ ubi carne implere quodlibet corpus volumus, id eo usque calefaciendum est nobis, dum intumescat; ube vero discutere & vacuare cupimus, continuandum est eo usuque, dum, quod intumuit, subsadat*; When we would make any "part fleshy, we must rub it 'till we make it swell; "but when we would discuss or lessen the bulk of it, "we must still rub on, 'till the part which has swelled shall subside."

And in another place (f), *Ferulas parvas ac leves modice illitas grucilibus partibus incutiunt, donec modicè attollantur*; It is usual to strike gently upon parts that "are too lean with small rods slightly greased, 'till "they begin to be plumped up." By thus striking upon the buttocks of a boy every day or every other day, he tells us, that in a short time, from being very lean they became very fleshy.

Hence it appears, that friction may sometimes produce quite opposite effects, *i. e.* if it be hard with rough dry woollen clothes, especially such as have imbibed the fumes of burning aromatics, it will be of service in the cure of weak fibres; whereas it will soften the fibres when too rigid, if it be gentle and used

(d) De Sanitate tuenda, Lib. V. cap. 3. Charter. Tom. VI. pag. 143.
 (e) Meth. Med. Lib. VII. cap. 6. Charter. Tom. X. pag. 172, &c.
 (f) Meth. Med. Lib. XIV. cap. 19. Charter. Tom. X. pag. 336.

used with oily substances, as it will by this means attract the humours and relax the solids.

S E C T. XXXVI.

FROM hence the too great elasticity of a fibre is understood, as also the method of curing it, being generally the attendant upon and effect of (31) stiffness.

It has been already explained what stiffness is, which always increases in the same proportion with elasticity; for a body perfectly hard, which no force can bend, is scarcely to be found. For which reason, as elasticity (as was said §. 29.) depends upon that power, by which the constituent parts of a fibre endeavour to cohere, and this power is proportionably greater in a fibre that is too stiff; it plainly appears, that too great an elasticity must always accompany too great a stiffness.

Balls made of soft clay, if they strike against one another in opposite directions, will stand still; but after they are baked in an oven they will become elastic, and fly back upon the congress.

S E C T. XXXVII.

WHY laxity prevails in children, women, and idle persons? on the contrary, in adults, in men, in those who exercise, the fibres are hard and stiff, and consequently all the solid parts? as also why there is a strong contraction of them, when divided?

Why in children.] See §. 30. For their fibres and vessels are not as yet become callous, as they will afterwards by the activity of life.

In

In women.] It is certain from anatomy, that the body of a woman is, *cæteris paribus*, much softer than of a man. This depends on the will of the creator, who hath so disposed the body of a woman, that it might admit of being greatly distended without much detriment; to the end that it might contain and nourish the fœtus, and accumulate the menstrual plethora. It contributes much too to this purpose, that women in general are not so much accustomed to hard labour as men.

Idle persons.] See §. 25. numb. 2. and §. 30.

But the contrary in adults,] because the longer a man has lived, the oftner and the stronger have the consolidating powers been applied to the fibres. A boy has all his limbs flexible and obsequious, but a decrepid old man is stiff in every joint; nor can any reason be assigned why this should hold more in men than in women *cæteris paribus*, but the original frame of the body so constituted at first by the appointment of the creator.

Those who use exercise.] How much bodily exercise contributes to strengthen a weak fibre has been observed already §. 28. numb. 2. For that which we call tenacity in the firm parts, is the effect of life continued: the less animal motion therefore any one superadds to the vital motion, the weaker his solids remain. The man, who does no work with his hands, will have his hands soft and tender; but he, who works hard with them, will have them hard and callous, and at length immoveable and stiff.

A strong contraction, &c.] When a separation is made in the solid part of a living body, the parts divided always retreat from one another, because the power, with which the elements of the fibres cohere, necessarily draws back each of the extremities. The stronger this power is therefore the greater will the gaping of the separated parts be: hence a wound in a lax body soon heals up; whereas in a rigid body

wounds gape wider, and are more difficultly consolidated.

DISEASES of the least and larger VESSELS.

S E C T. XXXVIII.

THE diseases of the least vessels, which are made up of simple fibres (21, 23) united together by application, interweaving, or contortion, proceeding from the same causes, have the same nature, effect, and cure; and are therefore to be understood by what is said from 21 to 38.

The diseases of the fibres being considered, and consequently of all the solid parts of the body, so far as they consist of fibres, it appears to how great a simplicity the diseases may be reduced, which occur in all the solid parts.

As then the elementary particles applied to each other constitute a solid fibre, so we may conceive the least fibres to lie contiguous to each other in every point of their adjoining sides, and thus they will cohere lengthways only. If two such fibres be applied to each other in a parallel direction, they will constitute the least membrane that is capable of being formed; if a thousand of them lying close to each other be united, they will form a broader membrane, but not a thicker. So that the most simple membrane we can conceive is that which consists of fibres longitudinally united together.

Now the strength of a fibre has been observed to depend on the cohesion of its elementary particles; but every elementary particle of a fibre, which constitutes the most simple membrane, coheres with the elementary particles of the two fibres lying next it on each

each side; for which reason the strength of a fibre, joined to other fibres on each side, is twice as great as it was before in the simple fibre by itself.

Hence the strength of the fibres increases by their being united together in the most simple membrane. But the fibres, which form the edges of the most simple membrane, have only by one half a greater force of cohesion in their elementary particles than a simple fibre, as they have another fibre contiguous to them on one side only.

Now if a membrane consists of fibres interwoven or twisted together, the strength of the fibres constituting the membranes increases in proportion as their points of contact increase.

From whence it is plain, that that part of the most simple membrane, which constitutes its edge, is most easily capable of being separated from its cohesion with the rest.

If such a most simple membrane be conceived to be turned round into a hollow vessel, then every fibre will be placed between two others, and there will be no edges at all; the cohesion of all the fibres constituting the most simple membrane thus turned into an hollow vessel, will be twice as strong as it was in the simple solid fibre.

Now such a vessel made by the convolution of such a most simple membrane, is to be called the least vessel.

But all the diseases of such a vessel depend only on the too great or little force, with which the elementary particles of the fibres cohere with one another, and with those which lie next to them. But of these we have already treated under the diseases of a simple fibre.

S E C T. XXXIX.

THE larger vessels being composed of the
least (38) united together by application,
H 2 interweaving,

interweaving, or twisting together, are subject to two different sorts of diseases. The first of these depends on the diseases of the smallest vessels (38), whereof the larger is composed, and so its origin, nature, effects and cure, must be taken from thence (38). But the latter depends, 1. On the force wherewith the fluid flowing through the larger vessels presses upon its sides by extending them : which sides, as they consist of other smaller vessels, are deprived of their liquids by this pressure, have their sides united, and grow together, in the form of a solid fibre, though thicker; which effect may also be communicated to the next adjoining small vessels. 2. From a concretion of the liquid with its own vessel.

As we have seen the fibres united lengthwise to have made a membrane, so we may conceive the smallest vessels, made by the convolution of the most simple membrane, to be applied to each other, and to make a membrane too; which again convolved will make a vessel, not of the smallest kind, but a larger; not consisting of simple fibres, but of the smallest vessels instead of fibres.

As then the section of these smallest vessels made perpendicular to their axis is a circle, the several circles of these adjacent vessels can touch one another only in a point; and consequently the neighbouring vessels will touch one another in a line, that is, in a most simple fibre: the strength therefore of such a membrane, composed of the smallest vessels instead of fibres, will be increased in all the several places of their contact.

The smallest vessels therefore will consist of fibres united into a membrane: the next vessel to this in magnitude, or the last but one in simplicity, will be that whose membrane consists of the smallest vessels
instead

Sect. 39. the least and larger VESSELS. 101
instead of fibres : the last but two is not like the last
but one composed of the smallest vessels, but of the
smallest together with the smallest but one ; and so
on 'till you come to the greatest vessels in the body,
which are composed of all the orders of vessels that
are to be found in the body.

The aorta, which is the largest vessel we have, has
been proved by injections to consist of membranes
made up of lesser vessels, though large ones. The
membranes of the vessels constituting the membranes,
of the aorta consist likewise of other membranes,
though smaller ; and so on 'till we come to the last.
Ruyfch has shown by his art, that what were judged
before to be most simple solid membranes, consist still
of innumerable vessels.

So that the strength of the greater vessels continually
increases from the manifold concretion of their sides ;
and thus we begin to discern upon what the strength
and firmness of the human body depends.

If then it be asked, what diseases may occur in the
greater vessels, not upon account of the liquids they
contain, but as they are solid vessels ? It is plain first,
that they are liable to all the diseases of the smallest
vessels whereof they are composed ; but of these we
have treated already.

The latter depends, 1, &c.] When the aorta is
distended by the blood expelled from the left ven-
tricle of the heart, the canals are compressed ; whereof
its membranes are composed ; when the action of the
heart ceases again, the contracting aorta frees its ca-
nals from that compression. But as the smallest ves-
sels, which constitute the membranes of the greater,
are every moment thus compressed ; they begin by
degrees to lose their liquids for want of sufficient time
for their influx into them : by this means their sides
grow together, their cavity is destroyed, and they be-
come a membrane, but thicker and stronger : for the
cohesion of a membrane convolved into a vessel was
twice as great as that of a simple fibre ; but when a
vessel

vessel is made flat and grows together, there is a concretion of the opposite fibres, and the cohesion of such a membrane, formed of flat concreted vessels, will be much stronger than before.

In proportion therefore, as the power of the heart is greater, and the longer it has beat, so much the fewer will the vessels be, and the solids the stronger; for which reason, in very old age, their strength shall become immense; and at length, when the vessels, through their too great resistance, will no longer admit of any extension from the impelled liquids, an universal rest will ensue, or that fatal, but most easy, death, which is incident to extreme old age. Thus animals accustomed to excessive labour, shall grow old the sooner, their vessels becoming callous before their time.

Those boasters therefore deserve to be the object of our mirth, who give out, that they can prevent the wrinkles and inconveniencies of old age, by taking down daily a few drops of an Elixir; since it is the inevitable consequence of an healthy life to make all the vessels callous, and thereby bring us to our final period.

Medea's method was certainly much more discreet, who, by fomenting sapless trunks with warm bathings, obtained the reputation of restoring youth to old men (a).

2. From a concretion of the liquid with its own vessel, &c.] That is, when the contained liquor is robbed of its most liquid part, and it at length grows into one with its own vessel. It has been observed from all ages, that in diseases, where (as the Antients expressed it) the innate heat prevailed over the radical moisture, or where the power of the vessels exceeded that of the liquids to distend them, the blood became liable to run into such pellicular concretions, as a razor would scarce cut through. There certainly is a plastick quality in our liquids, nor is our food converted into humours, 'till such time as it has attained to it. Ruysch formed

(a) Palæphatus de incredib. Hist. cap. 44.

formed a thick cohering membrane from his own blood, only by beating it up with the branch of a plant called *Africana* (b).

Hence it is easy to see that the blood, which in acute diseases is already disposed too much to concretions by its inflammatory density, when it has lost more of its most liquid part by the violence of the disease, may possibly unite itself to its containing vessels.

But we have an evident instance, that even the greater vessels and their liquids may grow together. For that large canal, which, while we lay in the womb, conveyed blood from the placenta to the liver, grows together afterward, not into a canal folded up as it ought to be if its sides only collapsed together, but into a kind of round and solid chord, which affords us a plain proof that it concretes with its contained liquids.

The strength therefore of the greater vessels arises from three causes; 1. From the strength of the fibres. 2. From the collapsed or compressed vessels growing together into membranes. 3. From the vessels concreting with the liquids they have contained.

S E C T. XL.

HENCE may clearly be understood the weakness of the vessels, their laxity, strength, rigidity, elasticity, which are words that are frequently in the mouths of the ignorant, but are yet of such importance as to deserve a thorough consideration.

These have already been all explained, and are recited in this paragraph only as a summary of the several particulars which are to be gathered from this

H 4

simple

(b) Thesaurus 6. No. 7. & Thesaurus 7. No. 39.

simple doctrine; and the following chapters will shew, that innumerable diseases may be hence both known and cured.

DISEASES of weak and lax VISCERA.

S E C T. XLI.

THE weakness of the vessels and viscera we call that cohesion of their constituent parts, (23, 38, 39) which may be destroyed by so small a motion, as to make them incapable of discharging the proper offices, which the condition of health and life require of them.

A viscus or bowel is commonly defined to be an organical part of the body, which by its structure very much changes the humours brought to it, and so as to make this change subservient to the life and health of the whole body. Thus the lungs is a bowel that receives the whole mass of blood, and so changes it as to make it fit for passing through all the vessels of the body. So likewise the heart receives the whole mass of blood, and changes it in the direction of its motion and mixture. And the like may be said of the other viscera.

It is certain now from anatomical injections, that all the viscera consist of innumerable vessels disposed in different order in different viscera; and that on these depends the action of the viscera, whereby they change the humours brought to them. If therefore these vessels be weaker than health requires, they will act less upon the fluids they contain, and change them less. Thus if the lungs be too weak, they will not be able to change the chyle into good blood. If the liver be too lax in its vessels, the blood will circulate through it without secreting the bile, and a dropsy follow:

Sect. 43. weak and lax VISCERA. 105

follow : if the stomach fail through weakness, the whole affair of chylification will be disordered.

S E C T. XLII.

WHICH are different according to the difference of age and sex.

Of age.] All the viscera increase in strength by degrees, according as the vital powers have acted longer on them. Thus in their first origin the parts are all so tender, that they are almost in a state of liquidity ; by degrees the body acquires a greater firmness, 'till at last in extreme old age all becomes hard and stiff. Now between this greatest degree of strength and weakness there are infinite intermediate degrees which occur in the different times of life.

And sex.] For God has appointed it as a law to men, that in the sweat of their brows they should earn their bread ; and to women, that they should conceive, bring forth, and suckle children. And this constitution obtains even among those nations, who govern themselves more by the voice of nature than by municipal laws. Now in order to discharge these offices, a different degree of strength is required in these different sexes.

S E C T. XLIII.

THIS weakness arises 1. From the weakness of the fibres (24) and its causes ; 2. From the weakness of the smallest vessels (28) and its causes (38) ; 3. From the sluggishness of the liquid flowing through the greater vessels (39), which may depend on the diminution of its quantity, on its growing too thin and watery, or on the torpid motion of the muscles ; 4. On too great a num-

a number of the smallest vessels continuing too long inclosed in proportion to the age.

The two first of these causes has been already explained.

3. The action of all the viscera depends entirely on this, that the liquids, when pressed by the power of the heart, dilates the arteries; and that these pressing again by their strength and elasticity propel the distending humours: but all substances retain the longest motion once impressed, which under an equal bulk contains the largest quantity of matter, *i. e.* which are the most solid.

A certain degree of solidity therefore was requisite in the liquids moved by the heart, that they might not so soon lose the motion impressed upon them. When this due solidity is wanting they are said to be sluggish: this solidity of the constituent parts of our humours is acquired by the efficacy of the vessels through which they flow: and this efficacy is that force with which the distended vessels act again on the distending humours. When therefore the vessels are not sufficiently distended through too small a quantity of liquids, their re-action is less too, in which case the whole system grows weak and languid. For this reason also, when by wounds, or any other causes whatsoever, a large quantity of the liquids is drawn off, the food we take down is not converted into solid red blood, but all the humours degenerate into and become as thin as water.

On its growing too thin and watery.] Some Physicians have been of opinion, that the state of the human body would be then most perfect, if our liquids were all extremely thin, and thereby capable of passing through the several canals of the body with the greater expedition: but these have certainly mistaken the original constitution of the human fabrick: for correspondent to the different orders of vessels, its fluids are of a proportional thickness. For were our blood

blood as thin as water, it would ouze away through the open orifices of the vessels through which we transpire, whether seated in the internal or external surface of the body; or all the cavities of the body would be filled with humours, which however thin would not be thrown into motion. For the thickest part of the blood, *i. e.* the red, which in health is always contained in the largest arteries and veins, *i. e.* the red, receives the quantity of motion requisite to life and health from the two moving causes the heart and arteries, and communicates it to the rest. Our heat is produced by the attrition of this red part against its containing vessels; and whenever this red portion begins to fail, the part where it is deficient becomes cold. As we learn from leucophlegmatick people and girls who languish under the green sickness.

For which reason the adorable creator hath placed large red vessels round the medullary substance of the brain, which collected into the *medulla oblongata*, that those most minute vessels, in which all attrition is wanting, might be cherished with a gentle warmth.

The humours therefore growing too thin and watery may justly be ranked amongst the causes why the viscera are too weak.

The blood of a strong man springing from the vein presently coagulates into a scissile coherent mass: bleed a girl in the green sickness, and there flows from the vein a reddish, thin, watery substance, which will hardly coagulate at all.

The torpid motion of the muscles.] This has been treated of already §. 25. numb. 2.

4. It is absolutely certain, that a due degree of callosity is required in every different age, and the abolition of some of the vessels. Anatomists observe, that injections are performed with the most happy success in younger bodies. Thus we see, that as age increases many vessels are destroyed.

The gland thymus, which is so remarkable presently after the birth, is so diminished in an adult, as to
leave

leave scarce any mark of it behind. A woman who has suckled many children successively, from her plentiful fountains of milky nectar, when grown old and scraggy, shall have nothing left but her wrinkled skin, which scarce deserves the name of breasts. The scattered glands of the mesentery are quite shrunk up to nothing in men in an advanced age.

For it adds very much to the strength of the firm parts of the body to have many of the smallest vessels compressed and concreted into stronger membranes: but this concretion is owing to the strong motion wherewith the fluids are carried through the vessels: the stronger therefore this motion is, or the longer it has lasted, the greater is the consolidation of the body. And hence in a person just born there is a very great number of vessels, but a lax habit of the whole body: whereas in an adult, many of the vessels are destroyed, and there is a greater firmness.

S E C T. XLIV.

FROM this weakness (41) produced by the forementioned causes (43) arise many diseases, which are falsely imputed to a bad constitution, or supposed to be born with us; whereof the principal are, the easy dilatation and swelling of the vessels; an easy compression of them and inanition; a stagnation of the liquid contained in them; an increased resistance to the motion of the heart; a crudity of the liquids; their spontaneous corruption; unfitness to perform the vital, natural, and animal functions, with all the consequences following from hence, which as they are infinite in number, so are they likewise most difficult to cure, and most fruitful in producing new diseases; especially a cachexy and caco-chymy; 2. The easy rupture of the vessels
by

by internal or external causes, proceeding either from acrimony or violence of motion; the effusion, stagnation, corruption, evacuation, of the liquid necessary to life and health; the intercepted motion of the fluids by means of the broken vessels; the corruption of those fluids, whose sound state depended on that motion; which are likewise various, and chiefly a pthifick, empyema, dropfy, atrophy.

Here again a body that was found before is supposed to be rendered too weak in its vessels and viscera; and then will the changes wrought in its disordered functions plainly appear, and more especially the following.

Upon its being observed that the health of each particular man contained in it something singular and peculiar to himself, and at the same time that different bodies were as different from each other, both in the solids and fluids, though all equally in health, this singular constitution of each particular body, wherein it differed from another equally healthy, was termed its idiosyncrasy; and the faults which depended upon it were deemed incurable, as they were judged to pertain to the body from its first formation: and yet we are not to impute these diseases of too weak vessels and viscera at all times to their original formation.

A young lady of family is delicately brought up, and under a lazy life her little body grows weak and languid: whilst a country girl of a resembling make, in the early part of her days, by being accustomed to labour from her infancy grows strong and hardy.

The weakness to which the former is subject, with the diseases depending upon it, would be unjustly supposed to have been originally constitutional.

Let a very strong man lose a large quantity of blood by a wound, and in consequence of it fall into a dropfy, and we shall find a wonderful change in what is commonly called the constitution.

Whereof

Whereof the principal are, the easy dilatation and swelling of the vessels.] It has ever been a question from the very infancy of physick, how the viscera concoct their humours, nor has much been said to the purpose, 'till Ruyfch demonstrated that there is every where in all the different viscera a different conformation at the extremities of each artery; and the viscera seem designed to have given support to this conformation. If now the arteries become too weak in any of the viscera, they must necessarily be the more dilated; as the same force of the impelled liquid must in this case distend the sides of the vessels with less resistance: for which reason the weakened viscera will not prepare the same humours as in health, but such as are quite different, to the disordering of the whole body. Thus as soon as the structure of the liver is changed, the liquid separated by it is no longer bile, but a very different liquid of a much worse nature, as we learn from undoubted observations. So the vessels of the kidneys when relaxed will transmit blood instead of urine.

The dilatation of the vessels will also cause a humour of the whole or a part: for in those that have weak vessels and viscera, the face is puffed up, the cheeks bloated, the whole body fungous, like the body of silkworms when about to spin out their threads. And thus we see such people, while the disease is gradually creeping on them, are often apt to please themselves with the thought of their growing plumper.

An easy compression of them and inanition.] The vessels of a strong man of themselves indeed will contract so as to lessen the diameter of their cavity, but do not fall flabby together; on the other hand, they strongly resist all contraction greater than is natural. Press a dropfical leg and it will pit; but in a healthy and robust man the part pressed shall presently rise up again.

Stagnation of the liquid.] For the whole force of the heart almost is employed in dilating the arteries;

now if these are so weak, that when they are distended by the blood impelled by the power of the heart they do not sufficiently contract, the blood will remain unmoved in the dilated vessels: for there are two causes, which produce the motion of our liquids through the canals: 1. The power of the heart distending the vessels by the blood impelled into them; 2. The strength and contractility of the vessels, which when the motion of the heart ceases, propel the blood that was thrown into them by the heart: when therefore this contractility of the vessels is deficient, the liquids stagnate.

The resistance of the motion of the heart increased.] This perhaps may seem strange, since the debilitated vessels will more easily give way to the blood impelled by the heart; but if the debilitated arteries do not contract with a systole sufficiently strong, they continue distended and full; for which reason the very next moment the heart cannot so easily pour out its contents into the vessels, as they are already too much distended and full. We daily see very pale and bloated persons well enough while they lie still and motionless; but upon the least stirring they pant and blow, the heart throbs, the jugular veins swell, and they seem almost in danger of being suffocated: for while they remain quiet, the venal blood is brought to the heart with a slow motion and in a small quantity, which is again expelled; but when the celerity of the venal blood is increased by the motion of the body, the heart is not able to propel the blood so fast as it receives it through the vessels, which are already full.

Crudity of the liquids.] Whatever food we take down, it is called crude, as being of a nature foreign to our liquids, 'till it is digested by the vital powers. But if the viscera be weakened, their respective powers by which they conspire to change the food we take down into our own nature, perish. For to make the chyle good, it is requisite that all the viscera, whose office

office it is to assist in the formation of the chyle; should supply it with the humours which they prepare; it is therefore requisite that these humours should be duly prepared: if then the viscera are weakened, the humours will be such as decline from their proper nature; and thus the whole business of chyfication will be disordered. Thus the weak body of a young woman labouring under a chlorosis is not capable of producing good blood, even from the best sort of food; but instead of it forms a pale kind of humour resembling a little blood mixed with a great deal of milk: and from hence follow wonderful degenerations of the humours, and of consequence various and strange kinds of diseases. All the viscera contribute their part to change the aliments into our nature; if one or more of these therefore be debilitated; the assimilation fails, and a substance of a different position is produced.

Galen well advises (a), that in restoring weak people, we consider, *nutrimentum seipsum non concoquere nec in partes distribuere, nec alendi partibus assimilare, &c.* “that the aliment does not concoct itself or distribute “itself into the parts, or assimilate itself to the part “that is to be nourished.”

Spontaneous corruption.] The food we take down is changed and assimilated into our own nature by the whole action of all the vessels and viscera; this change is called *ωέψις*, concoction. But if the food we take down be of so tenacious a nature, or the powers of the body so weakened, as not to be able to digest it, then though it is changed indeed in the body, it is not assimilated into our nature, but still retains its own disposition, whereby if it be kept in a warm and moist place it shall turn sharp, putrid, rancid, &c. this is called spontaneous corruption. An example will explain my meaning. The strong viscera of a reaper shall produce good blood from rye-bread; and yet this bread, if deposited in a chemical vessel, and

placed

(a) Method. Med. Lib. VII. cap. 6. Charter. Tom. X. pag. 163.

placed in the same degree of heat with that of our body, and a little water be added to it, will change into the worst kind of acid; but his strong viscera shall overcome this tendency to acidity; let a weakly girl eat of it, and it shall retain its own nature, and growing acid bring on the heart-burn, griping pains, &c.

This change for the worse in a weak body is not indeed wrought entirely in the same manner as out of the body; but yet if the assimilating power of the human body does not prevail, the aliment always has a tendency towards this spontaneous change.

Ineptitude to perform the vital and animal functions, &c.] All the functions of the body in some sort depend on muscular motion; for the moving causes of all the humours, *i. e.* the heart and arteries, are all muscular: which functions cannot be performed without good spirits; as spirits cannot be prepared without the last and most perfect assimilation.

When therefore the viscera are too weak to elaborate the aliment to the last and greatest degree of perfection, that most subtle part, on which every thing in the body almost depends, begins to fail. Thus when a sickly girl begins to languish under a chlorosis, an unusual torpor creeps on by degrees, with great lassitude from the least motion, giddiness, and dullness of all the senses, all which indicate that the animal faculties are disordered; the palpitation of the heart after the least motion, the soft weakly pulse, and shortness in drawing the breath, shew the weakness of the vital actions; the languid or wonderfully depraved appetite, the great uneasiness after eating, the frequently costive habit, and the pale crude urine, shew the depravation of the natural functions.

And hence it easily appears, that numberless diseases may spring from this fountain, whilst all the functions of the body are by this means thus capable of being disordered; and from hence also we may easily discern the difficulty of a cure: for before this effect

fact can be obtained, the deficient strength of the solids must be restored : but this cannot be done, unless so much of the original nature remains in the body, as when freed from impediments, and furnished with what is wanting, may be able to form good blood out of that which is not blood, that is, from the food. Thus, for instance, if the lungs or liver be wasted, it is in vain to expect help from medicine.

But to this cause more particular is owing a

Kaxekia.] An ill habit (of which hereafter in a chapter by itself) is a weakness of such a nature, as to occasion a disordered and depraved nutrition through the whole habit of the body at once. This cachexy is produced, when all the liquids and solids deviate from the conditions required to form an assimilation : every cachexy necessarily has with it a *κακοχymia*; that is a degeneration of all the humours from the conditions required in health : for our humours receive their properties from the power of the vessels and viscera ; if these therefore be too weak, the humours must necessarily degenerate.

2. The easy bursting of the vessels.] Such a degree of cohesion is required in the solid parts that constitute the canals of the body, as may be able to sustain the force of the liquid impelled by the power of the heart, without a breach of their continuity. But when this cohesion is weakened, there is a danger of a rupture from the liquids being impelled with too great a force : thus those melancholy accidents so frequently occur, when men of tender constitutions have attained to their full growth, and their vessels being either naturally too weak, or not sufficiently strengthened by muscular motion, that upon calling out aloud, or singing, or running, an artery shall burst in the lungs, and they vomit out their blood and life together, or else shall afterwards pine away in a slow consumption. So those that who have the vessels of the kidneys very weak, shall often make bloody urine when carried roughly in a coach over stony ways.

It has farther been observed, that when the vessels are weakened, the humours degenerate into a spontaneous corruption, in which case they constantly become more acid : for our humours in health are of so mild a nature, that sound blood dropped into the eye shall give no pain : when therefore acrid humours flow through weakened canals, they will easily break through them. This we see in the scurvy, where a laxity of the whole body and acrimony of the humours oftentimes concur, in which case a rupture of the vessels and effusion of the blood under the skin occasion the spots that are so remarkable in this disease.

When the vessels are thus eroded by the acrid liquid, or broken by the too great violence of its motion, the humours they contained flow out; and when extravasated, stagnate, as they want the moving cause; and when they stagnate they turn to corruption, slowly indeed, as the air has not free access to them, but yet they putrefy. When the liquids issue out of the broken vessels, the circulation of the humour is discontinued, because of the rupture made in the vessels; and of course all the functions, which depended on the motion of the humours through sound vessels, are destroyed. For which reason, as this may happen in divers parts of the body, numberless diseases may arise, which though not easily to be reckoned up, may be reduced to certain classes, whereof the principal are these that follow.

[*Phthisis*, a phthisis.] So called from *phthisis* to corrupt. But the word is not used now among Physicians to denote every corruption, but to express a consumption of the whole habit of the body from a prevailing purulent cacoehymy, be the source of it in any part of the body whatsoever. When the too weak vessels are eroded or broken, the humours extravasated corrupt and inflame the parts about them through their acrimony. Thus blood collected in the cavity of the breast inflames the lungs which it touches; this inflammation is followed by a suppuration, and destroys the

the man by a true consumption of the lungs. Thus we easily discern how an empyema may be caused, which in a larger sense signifies every suppuration, but is commonly taken for a collection of pus in the cavity of the breast.

Ὑδρωψ, a dropsy.] All those who have this disease creeping on them by degrees, labour under a weakness of the vessels and viscera; and every dropsy that does not spring from some other preceding violent disease, has commonly this for its cause. For the transpiring arteries transmit their humours into every cavity of the body both great and small; but it has been observed, that the power, wherewith the very small orifices of the veins suck in the humours thus transmitted from these cavities, increases and decreases in proportion to the strength of the circulation: for which reason in acute diseases, where the circulation is too great, every part is dried up: and in languid chronical diseases an universal tumour succeeds by means of the gradually accumulated humours. To which we may add, that in very great weaknesses the evacuating power of the artery seems to endure longer than the absorbing power of the vein; so that in every state of the body, where the vital vigour diminishes, the watery humours begin to be accumulated.

Ἀτροφία, atrophy.] At first sight this seems to be an evil opposite to the former; but when the abdomen is become tumid to an excessive degree by means of an ascites, we see all the parts above grow less; and no wonder, since when the bowels are too weak, they cannot contribute their respective offices towards the last and most perfect concoction of the aliments, by which they are changed into our nature, and the lost parts restored: for life would of itself destroy the body, unless it was repaired by the food we take down. Nutrition may therefore become defective through this cause only; and this deficiency is called an atrophy.

S E C T. XLV.

WHICH (41, 42, 43, 44) if any one accurately observes, he will distinguish the original, the presence, the event, not of this (41) disease only, but of abundance of others too, and those the most obscure, and will solely discover the effectual and safe means of obtaining a cure.

Whoever attentively considers what we have said above, will easily conclude, that all the functions of the body may be injured by the debilitated action of the vessels on the contained fluids; because the soundness of them all depends on the action of the solids on the fluids, and of the fluids on the solids; and consequently, that this is the true source from whence a great number of diseases take their rise. Where then the effects of diseases derived from weakness are obvious to the senses, there can be no difficulty in knowing the cause; but oftentimes the most hidden diseases owe their origin to this cause only. If the too weak vessels of the lungs break and throw out a crimson stream of bright and florid blood, it is easily known, that a preceding weakness has been the cause of this disaster. But if the resembling small arteries in the brain should break, and by the effusion of the blood they contained bring on a mortal apoplexy, the latent cause of this grievous malady will be still the same. If the vessels of the liver break and extravasate their humours, which putrefying by stagnation inflame the parts adjacent, and at length after a series of painful suffering consuming the whole substance of the liver occasion certain death; the first origin of this disorder depends on the same cause. And so of all the other viscera.

There seems to be no better rule in the practice of physick than this, that in curing diseases we should

always consider the first cause from whence every other circumstance has flowed; for from this source only can be deduced any certain and effectual method of cure. They who attempt to cure a dropsy from weakness by cleansing the body with purges, wonder to see it grow just as tumid as before within a few days, whilst every humour flows into the flaccid vessels, and scarce any part of the liquids we take down is carried off by sweat or perspiration, and very little by urine. Whereas they that are so discreet as to investigate the first cause of this disease, after they have removed the distending load, will be careful to strengthen the lax body with bandages, and by a dry diet, corroborating remedies, and due exercise, will conquer the first cause of the disease from whence every other part of the mischief flowed.

S E C T. XLVI.

BUT in the application of these, the present weakness requires us to proceed slowly, as a sudden change can in no case whatsoever be attended with greater danger.

The judicious Hippocrates condemns sudden changes in all diseases whatsoever, saying (a), *quod paulatim fit, tutum est, tum alias, maxime si quis ab altero ad alterum transeat*; "that what is done by degrees is safe at all times, but especially when the transition is from any one state to a state quite different." This general rule is more especially to be observed in the cure of weak vessels and viscera. Should any one in this case imprudently accelerate too much the motion of the humours through the vessels, either by stimulating medicines or an increase of the muscular motion, the too weak vessels and viscera would generally break, as unable to sustain the additional force, and instead

(a) Aphor. 51. Sect. 2. Charter. Tom. IX. pag. 88.

instead of relief, death would be the consequence, through the wretched mistake of the Physician.

Whoever should treat a man labouring under an hæmoptoë, from weak lungs, with strong exercise in the first place, would only cause the wound, that is not yet consolidated, to break open again by the accelerated motion of the blood : so that in this case we stand in need of the greatest caution, and in prudence are obliged to proceed very slow.

S E C T. XLVII.

Remedies therefore (28) are to applied slowly, cautiously, from the mildest to the most efficacious ; and when the vessels are strengthened by the use of these, strong muscular motion is to be continued, 'till it is certain from all appearances, that the vessels and viscera are become sufficiently compact, solid, and callous.

Whatever has been said concerning the cure of a fibre when too weak might here be repeated. But we must be particularly careful to proceed gradually, 'till health be restored. If we attempt to cure these diseases by muscular motion, we must begin with the most gentle, then by degrees and cautiously increase it, continually having in view the effect produced by this motion in the body of the sick. If, in a dropsy arising from the weakness of the vessels only, the patient should be directed to use violent motion, the consequence would be suffocation : but if the quantity of the distending waters be diminished, the lax parts be strengthened by bandages, and medicines moderately warm be first administered, and then stronger, and the patient after this be directed to use gentle motion, and increase it by degrees to the most violent ; we may be assured, that the body will by this means be strengthened, and the disease conquered.

But it is not enough to conquer the disease; we must also remove the causes from whence it has proceeded, without which it is easy to foresee that it will certainly return. For when you have carried off the waters collected in an hydropical person, you have only restored the body to the state it was in before it grew dropfical of itself: so that the parts which then were lax ought now to be strengthened.

But how shall we be able to distinguish, whether the compages of the viscera, that was before too weak, is now grown sufficiently strong? If an equable and healthful heat be discernible through the whole body, for in weak people the heat fails; if after drinking the body swells neither universally nor in any particular part; but more especially if there be a lively red colour to be seen in every part, where the vessels are conspicuous, as not being covered by the skin, such as the lips, tongue, fauces, gums, corners of the eyes; for from these circumstances we may safely conclude, that the vessels and viscera have attained to their due strength.

When the cure is thus far advanced, it is by no means requisite to strengthen any farther; lest we should bring on the opposite disease of too great rigidity: the body is only to be preserved in the degree of strength which it has acquired, and all those particulars carefully avoided, which have been ranked among the causes of too great weakness; otherwise the disease will soon return. This is what we frequently complain of in young persons of the female sex, lately cured of the green-sickness; for whilst they cannot be prevailed with to refrain from sipping warm liquors, and had rather lose the strength they have gained by sloth and indolence, than preserve their health by exercise, they not only give more trouble than is necessary to their Physicians, but bring upon themselves at last an incurable disease.

S E C T. XLVIII.

HENCE it appears, that what has been delivered concerning the virtue of aliments, is in some respects true, and in others false; that the exercise of the muscles strengthens the fibres; that the exercise of carriage dissolves what is coagulated, and strengthens what is relaxed, without loss of strength; that the blood and gore is very thick, heavy, and smooth, in very strong people; but in such as are very weak, it is broken, light, acrid; that abundance of diseases, in appearance very different, may spring from the same root, which being removed they will cease of course.

That what has been delivered of the virtue of aliments &c.] Such as have wrote of aliments in an absolute sense, can never possibly make observations, which will hold good in all cases; because the virtue of the aliment depends not solely on the aliment itself, but more especially on the agents employed in its digestion; (see §. 25. numb. 1.) Whole nations have lived on vegetables and water only; others almost wholly upon fish and water; others on all those substances mixed together, which the earth produces of its own accord, or is made to produce by art, or which are supplied by the several parts of animals, as luxury has invented; yet these have all enjoyed a tolerable share of health, or most of them at least; nor has the variety of aliment occasioned any great difference in this particular. For there is such a faculty in the human body, that, by the conspiring action of all the vessels and viscera, it is capable of forming human blood out of very different aliments, which in all its own properties shall be very nearly the same. And yet the same kind of aliments shall be capable of doing

ing good or harm according to the different strength of the vessels or viscera. Flesh-meat salted and dried by smoke, with very coarse bread, shall suit well with the hard viscera of a plowman : were you to feed him with nothing but broths, he would soon grow faint and languid ; and yet these are serviceable to weak people, who, on the other hand, are not able to take down such coarse food without detriment (a). *Qui copiosos cibos conficere queunt, illis sorbitiones ne dederis, cibum enim excludunt, qui verò non possunt, his dato ;* " Give " not spoon-meats to those who can digest much meat, " for they pass off too soon, but agree well with " weaker stomachs."

No food therefore is to be called wholesome in general, and he that should ask, what food is wholesome, might as well ask, what was the best wind without saying whither he was bound.

The exercise of the muscles, &c.] Of this see §. 25. numb. 2. and §. 28. numb. 2. For by muscular motion only too plentifully used, the opposite disease of too great rigidity may be brought on. What an immense difference is there between the flesh of an ox, fatted in the stall, and of one that by hard labouring at the plough has hardly any juices left within him.

The exercise of being carried, &c.] Muscular motion strengthens the body but fatigues it too, and destroys the spirits as much as it gives them ; so that to cure very weak people by this means is absolutely impossible. Instead of this motion therefore weak people ought to be carried ; and at first indeed in a very gentle manner, as by swinging on a rope with a slow oscillatory motion (b) : after this it may not be improper to be carried in a litter ; then in an easy chariot or chaise ; afterwards in a coach upon the common roads and streets ; and lastly on horse-back, riding sometimes harder and sometimes more slowly. Thus are the most difficult diseases to be cured, and the patient

(a) Hippoc. de effect. cap. 12. Charter. Tom. VII. pag. 633.

(b) Mercurialis de arte Gymnasticâ, pag. 247.

patient has well nigh every advantage of muscular motion without almost any the least loss of spirits. These exercises are all of them more especially serviceable on these three accounts; 1. As the pendulous viscera receive strength from these agitations, and the several concretions formed in the humours are partly broken by the concussion, and partly by the increased powers of the vessels and viscera. 2. As the remaining fæces of the last digestion are hereby discharged from the *primæ viæ* in such persons, as would otherwise retain them, through want of power in these viscera to discharge them: for which reason exercise is particularly adviseable an hour or two before a meal. 3. As the force and efficacy of the air on the vessels of the lungs is hereby increased, and the surrounding atmosphere, which presently grows warm with the heat of the body, is continually renewed; which more especially is obtained by riding on horse-back.

That the blood, &c.] We call that dense blood, which has the greatest weight under a given measure; but this depends on the pressure of the vessels. For every thing almost that we take down, as likewise the chyle and milk prepared from it, are lighter than blood. Blood extravasated, and free from the compression of the vessels, becomes lighter than it was, whilst within the vessels. The blood therefore is so much the more compact and solid, as it is more consolidated by an increased strength in the vessels; and for this reason in acute diseases, where the action of the vessels on the contained humours is too great, the blood becomes more ponderous and dense. Blood springing from a vein or a wound in a very strong man is thick and black: hence Homer says (c), when Ajax wounded Hector, *the black blood sprung forth*: and elsewhere he speaks of the black blood of his heroes (d). But there is likewise a lentor in such blood, by which it presently forms itself into a solid mass.

This

(c) Iliad. Lib. VII. pag. 124. μέλαν δ' ἀνεκένειν αἷμα.

(d) Ibid. pag. 26. τὸν τοῦ αἵμα κακὸν τοῦ, &c.

This is always the case of arterial blood in strong men: but after violent labour, or in acute inflammatory diseases, the venal blood too coagulates in the same manner almost immediately. In such blood also there is this property, that if it be applied to a sound eye, it will give no pain; so mild is sound blood, (and yet there is something of a brackish taste in it, though greatly diluted) so as to give no offence by its acrimony to parts of the most acute sense: for whatever is bred in the blood, that is of too acrid a nature, is carried off by urine, stool, sweat, &c.

In such as are very weak it is broken, &c.] It is difficult to examine the blood of a sound man hydrostatically, because it immediately coagulates and rarefies when freed from the pressure of the vessels. And yet Mr. Boyle, to get some information in this matter, though not very accurate, (as himself confesses) (e) received the blood of a sound man in an oblong phial; and when it had stood quiet, and the bubbles were gone, he marked its height with a diamond; then washing out the blood, he filled the same glass with water to the same height, and then found that the specific gravity of good blood exceeds that of water about a twenty-fifth part: but from what we have observed it is plain, that the power of the vessels and viscera forms a blood from the aliments which is more solid, and consequently more heavy, than the aliments themselves: for which reason, as this power is languid in very weak people, the blood in them is less consolidated, and consequently more broken and light, 'till at length it becomes as thin as water. This we learn by a dropsy, which will sometimes arise from inactivity and weakness only.

But a more than ordinary acrimony generally accompanies too great a thinness of the blood; whence erosions of the weak vessels easily happen in very tender people, as also spitting of blood and disorders of the

(e) Hist. sanguin. human. p. 11.

the like kind. And for the same reason these persons are so frequently subject to sharp and salt catarrhs.

Abundance of diseases, &c.] While the human liquids flow through canals of a proportional diameter, and every decreasing series of liquids is carried in its proper vessels, the several functions of the vessels and viscera are duly discharged. When the debilitated vessels are too much distended by the impelled liquids, and admit foreign humours, the consequence is nothing but disorder; this simple cause may be the origin of numberless diseases; and all the diseases from this cause be removed, by restoring the natural strength of the vessels. One example shall suffice out of innumerable that might be alledged. The *tunica adnata* of the eye has naturally no red blood in its vessels; but if these by any cause be relaxed, the red blood enters, and remaining in them, brings on an ophthalmia, which at first is oftentimes to be cured by the application of cold water, by which the vessels being contracted repel the red blood that was in them, whereas the application of emollients and laxatives would increase the disease.

This shews the great use of considering this simple disease, as it prepares the way to understand and cure others that are very intricate, which depend on the same origin.

S E C T. XLIX.

FROM the same principles the knowledge and cure of laxity of the vessels and viscera is to be drawn.

Since laxity is one kind of weakness, as has before been observed, whatever has been already advanced may be applied to it.

The

The DISEASES of too strong and rigid VISCERA.

S E C T. L.

TOO great rigidity of the vessels and viscera is such a cohesion of the parts (23, 38, 39) whereof they are made up, as does not yield to that degree of motion, which ought to move and change them, in order to produce the effects which depended upon that mutability in the time of health and life.

During the whole time of our life the vessels of the body are changing, since they never continue two moments in the same amplitude, but are one while distended by the force of the liquid impelled from the heart, and again contracted in all their dimensions by their own strength. Such a cohesion therefore is required in the constituent parts of these vessels, as that they may readily give way : but if this cohesion be so great, as to hinder them from yielding, or not sufficiently, it is the disease of too great rigidity in the vessels and viscera.

What the viscera are has been already observed §. 41. and it was also observed there, that all the viscera produce their peculiar effects by the fabrick of the vessels whereof they consist : but all the vessels act only on the fluids, whilst they contract and endeavour to lessen their own diameters : and when these are once contracted to their smallest diameter, then their power ceases, and acts not again, unless the vessels be again distended by the impelled liquid. There is required therefore such a flexibility in the vessels, as that they may yield to and be expanded by the impelled liquid ;

Sect. 51. too strong and rigid VISCERA. 127
liquid; and then, when the impelling force ceases,
contract themselves again.

It is farther required in all the viscera, which are so
contrived as to secrete proper liquids through emissary
ducts, that the last of the secretory canals should have
a certain and determined size; lest they let go what
ought to be retained, or retain what ought to be se-
creted: and on this due proportion life and health
entirely depend.

There is required besides a different flexibility in the
different viscera of the body; much greater certainly
in the fine arteries of the cortical substance of the
brain, than in the secretory vessels of the kidneys:
for which reason nothing here can be determined in
general, but with limitation, to the various uses which
health requires.

S E T T. LI.

IT arises, 1. From all the causes that produce
too great a stiffness of the fibres (32);
2. Especially from the fibres being too violently
compressed together by the force of the propel-
led vital liquid; 3. From the union of the lesser
canals deprived of their liquid by the violent pres-
sure, with which the arterial vital liquid presses
the sides of the greater canals, whereof the prin-
cipal efficient cause is a muscular motion much
used; 4. From a concretion of the vessel with
its own liquid, either stagnating, dried up, or
coagulated.

1. These have been treated of §. 32.

2. Though there should be parts in the liquids
adapted to the restoring of the elementary particles
rubbed off, and wasted by the actions of health; yet
it is required (as was remarked in the cure of a weak
fibre) that these should be applied to their respective
places

places by the propulsion of the vital liquid, and in a manner united by pressure to the other elementary particles; which action, the stronger it is, the firmer is the structure of the fibre thereby made or repaired. Now the same power, that joins the elementary particles of the fibres together, presses the fibres, which are composed of them thus united, more strongly toward each other, and makes their cohesion the greater.

3. This has been treated of §. 39. numb. 1. For the membranes of the larger vessels are made up of smaller vessels: but the smallest vessels are much less distended by the power of the heart than the greater, upon which the heart acts in a manner with its first force, and its powers entire: for which reason, when the greater canals are distended, the smaller vessels, which constitute the membranes of the greater, are made flat and impervious, whereby they grow together, and their strength is increased. Now muscular motion much used increases the motion of the heart, by moving the venal blood more swiftly towards it; from whence follows a greater impetus through the larger vessels, with all the other consequences already mentioned. And this is the chief reason why muscular motion strengthens weak bodies so well.

4. This has been treated of §. 39. numb. 2.

S E C T. LII.

WHEN this takes place in the vessels, it produces, 1. Either the same or resembling effects with those that proceed from too stiff a fibre (33); 2. It produces a strong tendency in the fibres of the vessels to approach towards the axis of their respective canals; to contract their cavities; to press, compress, repel, expel, their liquids; and hereby to resist their protrusion from the heart, and of course the action of the heart itself; to be more difficultly dilated, and hereby to interrupt

Sect. 52. too strong and rigid VISCERA. 129

interrupt the equable motion of the blood and consequently of all the secretions, to diminish the quantity of the blood which would otherwise be thrown from the heart at every time of beating; to hinder the heart from emptying itself entirely; to produce polypus's of blood; and by compressing the fluids, and robbing them of their most fluid parts, to condense it and bring on suffocations and death. 3. If there be any wounds in the vessels, it causes them to gape wider by means of the strong force wherewith the parts of the vessels are drawn towards the particles, whereto they cohere; if they be cut asunder, it diminishes or quite closes the orifices at their extremities.

1. Of these we have treated already.

2. A line drawn from the apex of a conical canal to the center of its basis, is called its axis. Whilst our flexible canals are distended by the impelled liquid, they are in a state of violence, and the longitudinal fibres, which are dilated into an arch, endeavour to return to their former length: the orbicular fibres also when distended endeavour to return into smaller circles. By both these actions the sides of the canals are drawn nearer to their axis: which is the sole action of our canals, so far as concerns the endeavour of the fibres to restore themselves. Now it is evident, that as the firmer the structure of the sides is, and the greater their elasticity, so much the stronger will this endeavour be.

But whilst the sides of a canal approach nearer to each other, the cavity must necessarily be diminished, and the contained liquid the more pressed: but since the liquid cannot be expressed so fast though the converging extremities of the arteries, nor be driven back to the heart, (for that the valves of the aorta will not admit of) it must be compressed, repressed,

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and

and condensed: for all bodies that are both porous and flexible will be reduced into less spaces in proportion as the compressing powers increase. And this seems to be the reason why chyle and milk, which are always lighter than blood, are changed into solid and compact blood, being impressed by the repeated actions of the vessels.

But all the new liquids that pass into the body enter always by the veins, whether they are conveyed through the mouth in our meat and drink, or are drawn in by the absorbent vessels which are spread over the whole surface of the body; as the veins easily dilate and admit them all. But when they have passed from these into the arteries, if these arteries are stronger than is required to health, the introduced liquids are presently carried off. For which reason we plainly see, why lean and strong men oftentimes eat more than twice as much as fat and idle men, and though they have but few stools, do notwithstanding not grow fat. The food they take indeed enters the lacteal veins, and is thence conveyed into the *vena cava* and the right ventricle of the heart, but is so attenuated in passing through the pulmonary arteries, and afterwards through the whole arterial system, as to be presently carried off by the perspiring vessels, and so vanishes into nothing.

And hereby to resist their protrusion from the heart, &c.] It is to be carefully remarked, that though the power of the arteries be increased, yet they do not therefore presently bring on a greater resistance to the heart than is requisite; for the strength of the heart increases with that of the artery, as the influx of the venal blood into the cavities of the heart, the circulation of the arterial blood through its substance, the influx of the spirits into its muscular villi, are the causes upon which its muscular motion depends. But when the aorta contracts itself with greater force, it drives the blood more swiftly through the coronary arteries into the substance of the heart; whereby it applies

Sect. 52. too strong and rigid VISCERA. 131
plies the blood with more power to the cerebrum and cerebellum by the carotid and vertebral arteries; from whence follows a larger secretion of spirits; and consequently it increases the velocity of the blood flowing from the arteries into the veins, and by this increased velocity occasions a greater irritation of the heart. So that all the causes of the muscular motion of the heart are increased by the increased strength of the arteries.

While his æquilibrium continues, the food is most perfectly and speedily converted into our nature; a great degree of solidity is given to the blood, and as yet no detriment done to health. But when the strength of the arteries increase so far as that they are scarcely to be dilated, then follow all the mischiefs here related. For if the arteries be not first dilated, they cannot afterwards contract: but their contraction is the principal cause of the motion of the blood through the vessels; for the action of the heart only dilates the arteries, and then throws into them the blood that was contained in its cavities; the next moment the arteries contracting propel it. This clearly appears when a large artery is wounded; for the blood never flows out in a continual stream, but *per saltum*, with much less swiftness while the heart contracting dilates the arteries, and with much greater when these contract and the heart is in its diastole.

When therefore from any cause whatsoever the vessels are become so rigid, as not to admit of being dilated, or not sufficiently, then the power of the heart cannot entirely expel the blood out of its cavities, and being irritated by a wonderful kind of tenesmus as it were, it labours to do that at several times which it cannot do by one contraction; hence proceed the frequent palpitations of the heart and interrupted pulse, which are so observable in very old age; for in very long-lived people the great vessels about the heart have sometimes been found cartilaginous, and even bony, as the writers of medical ob-

servations can testify. Now when the motion of the heart is disordered, every function of the body is disordered too, as the heart is the source and origin of motion. For which reason no secretion or excretion continue to be performed as before; but when the blood begins to stagnate in the cavities of the heart, it generates a

Polypus, (so called from a fish named polypus) which fixes itself by several roots near to one another, and is a disease that is very frequent, obscure, and obstinate.

Malpighius, in his treatise of the polypus of the heart, was the first that gave light to this subject, which before was almost entirely in the dark, and shewed whence it was that these polypus's in the heart and large arteries arose.

For the blood of a sound man drawn from a vein presently grows thicker, and begins to form a concretion mass, separating from itself a yellow fluid. This mass in time coagulates more and more, and swims in the liquid that is expressed out of it, and if washed in pure water will turn white, seem fibrous, and if cut through will appear to be a cellular substance filled with a reddish colour.

The experiment of Rufsch beforementioned (§. 39) shews us how such a concretion, when once begun to be formed, will attract to itself similar parts out of the blood, and from their union become a kind of membrane.

The blood therefore of an healthy person, as appears from the experiments of Malpighius and Rufsch, consists of two parts that repel each other, but which the vital motion mixes together: hence, as soon as the blood of the soundest man rests but a little in the great vessels, or being but little moved is aggregated too much in the distended vessels, it is disposed to a kind of flocculent coagulation. These little fleeces run together, assimilate, and attract other parts like themselves, and so form little polypous masses, which

grow

Sect. 52. too strong and rigid VISCERA. 133

grow to an immense size by the same cause continued, and adhere to the vessels themselves, and to the *columnæ* and auricles of the heart, as appears from the observations made upon the inspection of dead bodies (a).

In slaughtered animals, the whole quantity almost of the blood being shed, there remains only a small portion about the right ventricle of the heart concreted into little oblong polypous masses: and hence the reason appears, why after the loss of a great quantity of blood, polypus's are often formed about the great vessels, and afterwards bring on the most miserable diseases. Thus I have seen a woman, who lost so much blood by means of an abortion, that she was laid out for dead; she survived it however, and was tolerably well whilst she sat still; but upon every the least motion, there presently followed an intolerable anxiety, a sudden dejection of strength, and most miserable panting, 'till by lying or sitting still she grew by degrees to be more calm and composed; and thus has she been these ten years confined to her bed. In this woman the same effects seem to have been produced as in slaughtered animals, that is, some polypous concretions seem to have been formed in her, which admit the blood to pass slowly through them, but upon a quick motion quite choak up its way.

This appears most clearly in such as are liable to fall into a syncope; for these, when they come to themselves sigh and pant; because the little polypous floculi of concremented blood are stopped in the pulmonary artery, which from a vast capacity immediately becomes extremely narrow; in which state they move forward and backward by the contraction of the heart and pulmonary artery, and the force of respiration, which is then always increased, and are sometimes dissolved; but such as are frequently subject to this disorder,

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upon

(a) Abridgm. Tom. III. pag. 70. Malpigh. de Polypo, and frequently amongst the writers of observations.

upon the formation of a polypus, are liable to palpitations of the heart all their lives after.

This disease would be most frequent in those very active girls, that are apt to faint away upon every strong passion, if their blood was not vitiated in an opposite kind to this polypous concretion; for in such as have great strength, and lead an active life, the blood is more inclined to concretion, and therefore requires a perpetual and equable motion to prevent it.

From these polypous concretions, whether formed in the cavities of the heart or in its greater vessels, arise such irregular or terrible symptoms, that they have often been attributed to greater causes. Such a polypous concretion of the size of a pigeon's egg, without any adhesion, lying loose in the left cavity of the heart, has produced a most dreadful disorder (b).

There is but little hope of curing a confirmed polypus. There are many remedies cried up as effectual, but very seldom do good. All that can be hoped for is, to dilute the blood, and so throw it into a state more remote from concretion; *i. e.* to introduce by art that cachochymy which consists in the blood's being too thin, to the end the polypus may not be increased by the opposition of new matter, but by degrees be worn away by the constant attrition of the blood, which is every moment passing by it.

3. If our solids had no contractility, a wound would gape no wider than the thickness of the instrument that made it; but we see wounds made with the finest instrument gape almost immediately: for the force, wherewith the firm parts cohere, causes both the extremities to recede from each other. The greater therefore this force is, the more will the parts that are cut be drawn asunder from each other. When therefore the vessels are quite cut through, the same power will cause their extremities to retract, and hide themselves under other parts; and thus in this case hæmorrhages will be sooner stopped in stronger than in weaker

(b) Aët. Physic. Med. Vol. II. pag. 5.

Sect. 54. too strong and rigid VISCERA. 135
weaker people, as the contractive power of the orbicular fibres is stronger in the arteries of robust people.

S E C T. LIII.

FROM these (31, 32, 33, 34, 35, 36, 37, 50, 51, 52) accurately understood, we may easily learn how to know the rigidity, elasticity of the vessels, and their effect, past, present, or to come, their present and approaching action, with their cure,

We have already in the foregoing chapters, §. 27 and 34, laid down the method of discovering the diagnosis of a disease when present, the recollection of one past, the prognosis of a future one and its effects, and lastly the curative indication.

S E C T. LIV.

FOR this is wrought 1. by the remedies proper to cure the rigidity of a fibre (35).
2. Those especially, which diminish the quantity, the density, and pressure of the vital liquid.
3. Which suspend the muscular motion. 4. Those which moisten, mitigate, soften, dilute, resolve, and absterge.

1. These have been treated of already.

2. Those which diminish the quantity of the vital liquid.] In curing a fibre too rigid the solids only were considered: but in curing the vessels and viscera that are too rigid, regard is to be had both to the solids and fluids. Among the causes of too rigid viscera, §. 51, was reckoned the strong action of the propelled vital liquid, binding the fibres together. By the vital liquid we mean whatever flows from the heart and

returns to it again. But the more of this liquid is taken away, whilst life remains, the less is the action and attrition of the solids against their contained fluids, *i. e.* the force of the circulation is diminished: for if the quantity of the vital liquids be diminished, a less quantity must of course return to the heart. But the influx of the blood returned by the veins into the cavities of the heart is justly reckoned one of the causes from whence its motion proceeds, as has been observed (§. 28) and elsewhere: the muscular contraction of the heart therefore must necessarily be hereby diminished in its force and velocity. This is plainly to be learnt from bleeding, as it is oftentimes capable of so restraining the violence of life in acute distempers, as to cause an universal remission and abatement; nay when continued even to fainting, it is capable of carrying off a fever at once: as was once said to Galen by a man that saw him cure a fever in this manner (a), *O homo, jugulasti febrim*; “Sir, you have murdered the fever.”

From the earliest ages it has been a dispute among Physicians in what manner too great a quantity of the vital liquid ought to be lessened. The most simple method, and most agreeable to nature, which so often cures diseases by an hæmorrhage, seems to be by opening a vein; but the followers of Erasistratus condemned all bleeding, and would have the too exorbitant quantity of blood diminished by abstinence, which they enjoined their patients to observe for three days together: this famous διατριβὴ ἀσινία, or *three days abstinence*, was condemned by Hippocrates in his treatise concerning the diet proper to be given in acute distempers. Galen wrote a whole book (b) in confutation of this opinion, and shewed it to be false both by reason and experience; though it has since been unhappily revived by some Chemists.

For

(a) Method. Med. Lib. IX. cap. 4. Charter. Tom. X. pag. 206.

(b) De venæ sectione adversus Erasistrat. Charter. Tom. X. pag. 406, &c.

Sect. 54. too strong and rigid VISCERA. 137

For whilst they thus attempt to lessen the quantity of humours by abstinence, the most subtle parts fly off; the thickest humours are the more condensed in the larger vessels, and all is disposed towards a putrid acrimony. Whereas bleeding lets out the thickest part, that is, the red blood, and makes room for the use of diluents.

The density.] The blood of a healthy man always exceeds the density of water; and if it begin to degenerate into the thinness of water, his strength decays, as we see in hydropical patients. When therefore the vessels and viscera abound too much in strength, the vessels being emptied by bleeding, and the more dense part of the blood drawn out, it is advisable to throw in a watery diet, such as whey, barley-water, &c. in which water predominates; that the vessels being filled with these may be weakened, and a tendency to a dropsey introduced. Hippocrates scarce allowed any other than a watery diet in acute distempers.

Pressure.] All the aliments we eat or drink are lighter than the blood; it is by the continual action of the vessels therefore that these are compacted and consolidated into good blood. The less this power of the vessels is, the less the blood is compacted; as we see in weakly girls, through whose vessels there flows no solid blood, but a sort of reddish ichor. The fuller the vessels are, the more are the contained liquids compressed; for the force of the heart projecting the blood into the arteries, which are already very much distended, must compress the blood yet more to make them receive what was contained within its cavities. When therefore the fulness of the vessels is abated, this cause also of the pressure is lessened. Now the more dense our liquids are, with the greater impetus do they act on their vessels; to which action the re-action of the vessels on them is always equal in health. As the density of the liquids therefore is diminished, their pressure is of course diminished.

minished too. Now the more swiftly the blood is propelled through the vessels, so much the oftener in the same given time are the condensing causes applied to our liquids. For which reason in all diseases, where the power of life is too great, the wisdom of antiquity enjoined the most absolute rest. The pressure therefore is lessened by diminishing the quantity, the density, and the motion of the fluids; and, which necessarily follows, the too great strength of the vessels present or future is taken away.

2. What the motion of the muscles can do has been already observed, §. 28. numb. 2. §. 37, 43. numb. 3. §. 48.

4. Those which moisten.] Now what is it which in physic we term *to moisten*? It is to fill the body with more liquids than it had before; and likewise to dispose it to retain more than it formerly did. For if water be taken down, which stays not in the body, the body is washed all over with it indeed, but not moistened. Warm water drank alone relaxes all the vessels, but it softens and moistens much more if boiled with some farinaceous substance, and disposes the vessels to resist repletion less. All this is true, as to the solids, but as to the fluids there is a difficulty still remains; for the blood, through the too powerful action of the vessels upon the fluids, will begin to assume an inflammatory spissitude, in which case it will not easily mix with the water introduced. Thus in very acute diseases it is often seen, that a large quantity of water drank presently passes off by urine and sweat, and in a few hours time the urine shall become as red as before, and the symptoms not relieved. In this case the water seems to have flowed together with the blood through the vessels, but not to have been admitted to any close mixture or cohesion with it, and therefore to have been presently separated from it. And then the mildest saponaceous substances intermixed with water, of which kind are the juices of the summer-fruits, of the emollient herbs, honey, manna,

Sect. 54. too strong and rigid VISCERA. 139

manna, sugar, &c. do so divide the blood, which is too apt to run into concretions, as to make its mixture with the water more easy and lasting.

The moistening medicines are described in the *materia medica*; in all of which water constantly predominates. There are likewise such as add a kind of glutinous lentor to the water, which otherwise would pass off too speedily; these are of the farinaceous kind, and all the emollient herbs. To these are also added saponaceous substances, which divide the too great lentor of the blood: for this purpose crawfish soops are particularly commended in Greece, as they have been ever since the days of Hippocrates, for those dry consumptions called *marasmi*. In Italy viper-broths are highly valued; and in the room of these, broths of eels may perhaps commodiously be substituted: for in all these substances the juices are mild, moistening, and inclining to be viscous, which in such sapless subjects will do more service than could even almost be expected. If an agreeable taste be added to these decoctions, which of themselves are insipid, by the intermixture of some grateful herbs, they will constitute a noble remedy.

Which mitigate.] The medicines called lenient are so termed with regard either to the solids or the fluids: the former abate the too great rigidity of the solids: the latter blunt and inviscate whatever is acrid and stimulating; of which kind are all those that have been mentioned before.

Soften.] Emollients are of the same class with lenients, except that these relate to the solids only; lenients to both solids and fluids.

Dilute.] This term relates only to the liquids; and if these be diluted the solids are relaxed. But what is it that does dilute? Certainly water is the only proper diluent with respect to our blood; and all the rest, which are called diluents, are only in the quality of water. Salts indeed resolve and attenuate, but do not dilute. All spirituous liquids rather coagulate our humours.

humours. Very cold water likewise, as well as hot, coagulates the blood; warm water therefore is the best diluent. And this may be applied to the body by baths, vapours, clysters, fomentations, &c.

Resolve.] Too great strength was observed to be the effect of many vessels being grown together, which before were pervious. With respect to the solids therefore, resolvents should be of such a nature, as to be capable of opening the vessels that before were grown together; but this seems to be scarce possible; at least not very easy. But resolvents with respect to the fluids are all those medicines, which are capable of resolving the formerly fluid parts, that are now concreted into such particles as they consisted of before the concretion was formed. These they do, either by insinuating their own particles between the cohering particles of the concreted mass, or like stimulatives by increasing the force of the vessels, so as to procure a greater attrition, and oftentimes a division of the concreted substance; and sometimes by both these qualities united.

The red blood in the course of its circulation must pass through vessels, whose diameter does not exceed the tenth part of the thickness of an hair: but when drawn out of the body forms itself into such concretions, that it cannot pass through the largest canals: that now would most fully deserve the name of a solvent, which could divide again the concreted blood into such small particles, as that it might pass through the smallest vessels, as it did before.

As there are different kinds of concreting humours, so there are required different sorts of resolvents: the principal of which are enumerated in the *materia medica* under this number.

For the watery diluents resolve all mucous, glutinous, gummy, soapy, concretions, and yet many others are not to be resolved by water; for blood is not to be kept from coagulating by being put into warm water.

Many

Sect. 54. too strong and rigid VISCERA. 141

Many of the saline resolvents enumerated in the *materia medica* do very well discharge this office. The neutral salts are mighty well adapted for resolving inflammatory concretions; especially nitre and many of its preparations, which being lighter than sea-salt, and more easily to be combated with by our nature, is given to such good purpose in almost all acute diseases. The alkaline salts are commended chiefly for resolving glutinous viscid concretions, &c.

Saponaceous substances, especially such very mild ones, as sugar, honey, the juices, &c. are of great service in resolving many concretions, without raising any commotions in the body; whereas the stronger sorts, and especially the acrid and chemical, act by raising a violent motion.

Yet all these are very much assisted by frictions, whilst by an alternate pressure and relaxation the resolvents, intermixed with the blood, are as it were triturated with the concremented fluid. Thus certainly moderate friction, after exposing the part to a warm vapour, joined to the use of the most dissolving remedies given inwardly, has often dispersed such hard tumours of the glands, as seemed scarce possible to be resolved.

Absterge.] When any thing viscous or glutinous is so tenacious as to stick to a vessel, and obstruct the natural passages, if this viscosity be removed, that part of the body is said to be deterged. For this reason all abstergers are resolvents of concretions, especially those of the saponaceous kind. Such viscosity adhering to the vessels is seldom found in the vessels through which the motion of the humours is very swift; but in the smallest vessels, or receptacles where humours are collected for their proper use, they sometimes occur. And yet it would be a great mistake to reckon all such viscosity morbid; for certainly the whole inside of the mouth, gullet, stomach, &c. are lined with such a mucus, which, if it failed, would give rise to very bad diseases. To this class of abstergers

stergents belongs whatever dilutes, and whatever resolves, and most particularly whatever is saponaceous. And these are serviceable in curing the rigidity of the vessels and viscera, as they remove obstacles, and make the passage through the vessels perfectly free, by which means the circulation being made entirely uniform, is not so apt to bind the solid parts so close together, or condense the fluids with so much force.

S E C T. LV.

FROM all these (*viz.* from 21 to 55) the diseases proper to the solid parts are capable of being understood and cured: and the same principles also will furnish us with an answer to the following questions: What difference there is in the structure of the solid parts in the different times of life? Why a man grows, continues in the same state, becomes shorter and less? Why in the womb there is the swiftest growth of all? Whence he becomes lax, strong, rigid? Whence moist, full, dry? Whence he dies naturally by old age, and then of what disease? What diseases are for the most part peculiar to every age? What sort of diet, life, and medicines, are suitable to the several seasons of life? What truth there is in the doctrine of astringency and laxity in the solids, and what its use? Whence the most certain signs of the just degree of laxity and astringency in a man are to be drawn?

From what has been hitherto delivered, all the diseases of the solid parts are capable of being understood, as they must all arise from some disorder in their cohesion; from which doctrine many of the most useful deductions in physick may be drawn, and particularly an easy answer be given to the following questions.

What

Sect. 55. too strong and rigid VISCERA. 143

What difference there is in the structure, &c.] The nearer the human body is to its original, the more vessels, simple fibres, and membranes, does it consist of, the more easily do the vessels yield to the impulse of the liquids contained in them, and the greater is the proportion of the brain and nerves to the other parts. Examine the body of an infant just brought into the world, and you will find every part of it to be pulpy, soft, and moist; the hollows of the hands and soles of the feet are in every point bedewed with a gentle moisture, exhaling from the very small perspiring vessels; nothing is dry, nothing is callous; as the child grows older, numbers of the smallest vessels begin to be consolidated: thus their number lessens, and the strength of the solids increases; 'till at length, in extreme old age, the sapless trunk grows hard and callous, and numbers of the smallest vessels are lost; for which reason all the actions, that depend on the motion of the most subtle humour through the least vessels, begin to fail in old men; and the solids being grown too rigid, strongly resist the impulse of the fluids.

Why a man grows?] Hippocrates had observed (a), *Partes autem simul omnes discernuntur, & augentur, neque una prior altera neque posterior; majores tamen natura minoribus priores conspiciuntur, quam priores non existant*; "That all the parts are framed and grow together, nor is one part sooner or later than another; only the greater parts are seen before the smaller, but did not exist before them." And indeed when we consider the wonderful history of animal generation, so far as it is now known, from the most faithful observations, it seems only the unfolding of the parts that were pre-existent in the embryo. This is certain of plants, that the entire plant lies convolved in a fruitful seed, which is afterwards by degrees to be unfolded. Whilst therefore the greatest part

(a) De victus ratione sanorum, Lib. I. cap. 2, Charter. Tom. VI. pag. 455.

part of the vessels thus lie twisted together and convolved in the tender embryo, there must be a resistance to the motion of the liquids that are to be carried through them: but the consequence of liquids flowing through canals that resist them, will be the distension of them, and the stretching out of their sides in length: hence follows elongation and increase. But when the vessels are all unfolded, and the resistance to the motion of the liquids becomes less, then is the circulation most free through all the canals; then they are no more drawn out into length, as the liquids have now a free course through them; and the sides of the canals being grown solid by the vital motion, do not admit of being distended farther by the same force: in which case the body

Continues in the same state;] That is, whilst the quantity and force of the liquids impelled by the heart are in an æquilibrium with the resisting powers of the solids. For the body ceases not to grow, because the solids cannot be extended any farther, but because the vessels being all unfolded, the circulation is free, and prevents the liquids from pressing too forcibly against the canals. For if an obstruction happens in certain vessels from any cause whatsoever, even in an adult person, we find that the parts increase, though the velocity and quantity of the humours continue the same. This we see in a pregnant womb, which is capable of being expanded to so large a bulk; in the liver and spleen, which in case of obstructions grow to such a monstrous size; and so the invisibly small cutaneous vessels are greatly increased by the compressure of a neighbouring atheroma (*b*).

And possibly the wonderful increase discernible in some particular parts may owe its rise to some such latent cause. Thus have I known a girl, whose tongue has grown to so vast a bulk as to hang out of her mouth below her chin, and yet her deglutition, speech, and taste, were preserved entire.

Decreases.]

(*b*) Simson's system of the womb, pag. 24, 25, &c.

Decreases.] The vessels become so strong by the unavoidable effect of life, as in course of time to resist the motion of the fluids too much. From whence, by degrees, a general concoction ensues; the whole body becomes dry and sapless; the fat, which constitutes so large a part of the bulk of the human body, is almost wholly consumed; so that in the hands of old men we see the strings of the tendons left bare, without scarce any fat at all, that can be seen; those surprising ligaments, which lie between the several vertebræ, become so indiscernible, that the vertebræ touch one another; by which means the stature is diminished, the spine of the back bends forward, and as age comes on we grow round shouldered and stooping, till at last we consume away and die.

Why in the womb, &c.] That this is fact we are absolutely certain; for in nine months time the infant grows from an invisible speck to the weight oftentimes of sixteen pounds, and sometimes more. The reason seems to be, that the vessels are very tender, that lie near the little heart which beats strongly, and being for the most part convolved, make the more resistance to the impelled fluids, by which means they are the more lengthened and distended: the whole embryo is continually fomented with the warm liquor of the amnion, and thereby kept perfectly lax in all its parts; and the nourishment prepared in the body of the mother is continually thrown into it, and very equally distributed.

Whence lax.] If a man indulges himself in idleness and sloth, if he sleeps much, and at the same time feeds upon soft kinds of food, his body will grow big and unweildy, but his strength will not be increased, nor his vessels be consolidated, and consequently will easily give way, and be distended by the liquids wherewith they are filled.

Strong.] So long as the liquids are superior to the firmness of the solids, the body swells and is lax: but when the vessels are so far strengthened by exercise.

as to be able to sustain the force of the liquid without too great a dilatation, a man is said to be strong; as in this case there is a firm cohesion of the solid parts, and a due density of the humours.

Rigid.] The same causes continued that made the body strong, will at last make it rigid. Age, by degrees strengthens the body of an infant; exercise gives strength even to the weakest: a more advanced age induces an universal rigidity and callosity; too much labour brings on an untimely old age.

Whence humid.] All our veins easily dilate and fill with new liquids; which the firmer strength of the arteries again expels. A strong healthy man may drink an incredible quantity of water, which the veins will receive, and deliver to the heart, and then being distributed into the arteries it will be expelled out of the body; for the next day he returns to his old weight. But when the arteries are so weak as not to move their humours sufficiently, or not to expel what is superfluous, the liquids are accumulated and prevail over the solids, and introduce what is called a moist temperament.

Full.] A man is said to be full when his vessels are fuller of good humours than is requisite to an established state of health. In these men the vessels are so lax as to admit of being filled to a degree just short of a disease; should the humours therefore be increased, or rarefied by heat, or any other cause, they can no longer continue in a state of health.

Dry.] This is meerly from the increasing strength of the vessels. When the arteries contract with more force than is required to perfect health, the liquids are expelled, and the body grows dry: hence age and labour render the body dry by strengthening it.

Why a man dies a natural death, &c.] That is called a natural death, which follows from the constitution of the body by the unavoidable law of its formation: this happens from the elementary particles of the fibres uniting to each other, as also fibres with

Sect. 55. too strong and rigid VISCERA. 147

fibres, membranes with membranes, and the flattened vessels with each other; 'till at length the smallest vessels being almost all grown together, the circulation is performed in the greater vessels only: and these at last growing callous, and even cartilaginous and bony, (as has been found true by undeniable observation) hinder the free expulsion of the blood from the heart: and thus life ends in a gentle and most desirable death. Thus died Lewis Cornaro, after he had lived upwards of an hundred years (c).

Hence appears how vain the boasting of the Chémists was, whose promises fell very little short of immortality; at least they gave out that they could prolong life to what limits they pleased. See §. 39. numb. 1.

And of what disease then.] By meer cessation of motion in the heart, when filled and unable to empty itself into the arteries, whilst full, and too rigid to be distended by the power of the heart.

What diseases, &c.] The consideration of this matter is both entertaining and necessary, as a man is liable to different diseases at different ages.

In the earliest part of life a man is most liable to all the diseases of the nervous kind; because, as we learn from observation, the brain and its productions, *i. e.* the *medulla spinalis* and the nerves, are larger in proportion to the rest of the body, the nearer a man is to his original. Add to this, that as the brain is less firm at that age, the nerves, which are produced from the brain, are softer and more easily affected, besides that, the integuments are thinner; hence it is, that children are so apt to fall into convulsions; for a child can scarce have the slightest fever, but it is attended with a convulsion: pains of the belly from acidities, the infection of the small-pox or measles, whatever makes a strong impression upon the senses, a great noise, a glaring light, &c. will often throw

L 2

children

(c) Raadgeving om gezond en lang te leven, pag. 78.

children into convulsions; insomuch that Sydenham^(d), whenever he observed children after dentition to fall into convulsions, was accustomed to prognosticate the coming on of the small-pox, and generally of a distinct sort. And for the same reason, Hippocrates observing from what slight causes convulsions would arise in this early time of life, made no scruple to declare them not so hazardous before a child came to be seven years old, as they were afterwards, since then they could not be occasioned but by causes of greater consequence.

Another source of diseases in this tender age, is the quantity of humours being more than proportioned to the powers of the solids. In our infancy we are all disposed to be turgid and moist. And from hence arise those easy and wonderful changes of the cutaneous humours, which so frequently shew themselves in a manner as yet not well understood. This appears in the ulcers of the head, the herpes, the excoriations behind the ears, the arm-pits, &c. by which an incredible quantity of humour is discharged daily, and which if imprudently stopped gives rise oftentimes to the most troublesome diseases.

Afterward, about the time of puberty, the whole body suffers wonderful changes in both sexes; in the male tumours of the testicles, various inflations of seminal vessels, which are easily cured by gentle friction whilst exposed to the vapour of lighted amber, and at the same time giving a gentle purge: in the female, surprising diseases do often both precede and attend the first eruption of the menstruous flux.

When after this the body begins to resist any farther increase, and the vessels do not so easily suffer themselves to be extended, the force and quantity of the fluids are ballanced by the resistance of the vessels. In the mean time the sound viscera go on to generate new humours daily, and hence follow ruptures of the vessels, bleeding of the nose, spitting of blood, &c.

When

(d) Page 132.

(e) In Prognosticis et Coacis.

Sect. 55. too strong and rigid VISCERA. 149

When a man is full grown, the action of the vessels on the fluids is very great, by which means the blood is rendered dense and compact; for which reason acute and inflammatory diseases, at this time most frequently prevail.

As age comes on, the solids become more compact, the smallest vessels, by degrees, grow together and become callous; whatever depended on the motion of the most subtle humours through the smallest vessels, begins gradually to fail, the several functions of the brain and nerves begin to grow weaker, the humours degenerate into a cold and pituitous disposition, the circulation is performed only in the larger vessels, and at length death ensues by inevitable necessity. *Quia naturæ progressum, quia est ad siccitatem, effugere non licet, ideo senescimus & corrumpimur*, says Galen (f); “We therefore grow old and decay, because we cannot stop the progress of nature, which tends to dryness.”

Hippocrates was very careful in observing the various diseases incident to each particular age (g).

What diet.] While the child is in the womb, it lives upon the humours prepared by the mother. When it is born, it presently finds the way to its mother's breasts. Scarce any thing therefore but the mother's milk agrees well with infants. When the fore-teeth appear, more solid food, first reduced to a pulp is to be given; their bodies also should be often rubbed upon an empty stomach (h). Bread well fermented, made into a pap with milk or small broth, is then also very proper for them. When the jaw-teeth appear, they should by degrees be accustomed to harder food: but whatever is hot, vinous, and irritating, must be prejudicial to infants, as they are so subject to nervous indispositions.

L 3

Children

(f) Galen, de sanitate tuenda, Lib. VI. cap. 3. Charter. Tom. VI. pag. 169.

(g) Sect. 3. Aphorism. 24, 25, 26, 27, 28, 29, 30, 31.

(h) Galen, de sanitate tuenda, Lib. I. cap. 10. Charter. Tom. VI. pag. 55.

Children should be fed often, as their strong appetite requires; and Hippocrates acquaints us, that boys can very ill bear fasting (i). Such as are growing have great innate heat, and for this reason stand in need of a large supply of aliment, or otherwise the body will be consumed.

For such as are full grown and well, the rule of Hippocrates is almost sufficient (k); *Valetudinem excolunt, citra satietatem cibis vesci, & impigrum esse ad labores*; "that they who would take care of their health, should rise from table with an appetite, and not be slothful to labour." And because this age is liable to the most acute diseases, it is plain that whatever is apt to overheat should carefully be avoided. But let the diet be always proportioned to the exercise: for the man who labours hard at the plough, requires a quite different sort of food, and a greater quantity than the philosopher, who applies himself solely to meditation and study.

As to old men (*cum & facillimè jejunium ferant, & parvum habeant calcrem, hinc paucis egent fomitibus à copiosis namque extinguuntur* (l)); "as they bear fasting easily, and have but little heat, and therefore need but little aliment, and would be destroyed with a great deal," it is best to give them a soft kind of food very frequently; for as they are grown toothless, and become children a second time, they should live almost entirely upon milk, broth, and eggs, with a moderate use of wine, which is more especially beneficial to them, and is therefore called the milk of old men. In fermenting liquids there is produced a wonderful spirituous part that acts on the brain, and all the nerves instantly, and very powerfully; but if imprudently taken in too great a quantity, kills, and that very suddenly; or if it acts with less violence, shall

(i) Aphor. 13. & 14. Sect. 1. Charter. Tom. IX. pag. 23, 24.

(k) Epidem. Lib. VI. Charter. Tom. IX. pag. 500.

(l) Hippocr. Aphor. 13 & 14. Sect. 1. Charter. Tom. IX. pag. 23, 24.

Sect. 55. too strong and rigid VISCERA. 151
shall sometimes bring on a state worse than death,
such as madness and other disorders (*m*). This spirituous
part residing in the brisker sorts of wine when
new, is the greatest restorative that can be given in
old age. Cornaro absolutely abstained from wine during
the months of July and August every year; in
consequence of which his appetite failed him, and by
the middle of August he was become perfectly weak:
but as soon as he had drank new wine for three or
four days in the beginning of September, his strength
presently returned, and the vigour of a lively old
age (*n*).

What sort of life.] In their tender age when the
body is almost always in motion, children can hardly
be kept still, and bear it very ill if they are kept
from play by their too severe parents or masters. On
the other hand, if they are put to hard labour too
soon, their constitution will become robust indeed by
this means, but will decay before its time through
a senile callosity. Thus we see country-people, who
have been inured to too hard labour from their infancy,
become stiff and callous like old men by that
time they are forty years old.

It is no less faulty to put them too early upon an
application to severer studies: by this means indeed
they will often give surprising instances of genius
very early; but then they commonly drop soon, or
live stupid or unfit for any employment. Instances
of this kind frequently occur.

As to adult persons, it is most advisable for them
to keep up and support their strength by healthful
exercise; that the body grow not torpid, nor the man
lie buried in his own fat (as Justin says of Ptolemy
king of Egypt) (*o*) 'till he thereby loses his senses. Of
what use exercise is to the human body, has been already
explained, §. 28. numb. 2.

L 4

Galen

(*m*) H. B. Chem. Tom. I. pag. 806, 807.

(*n*) Cornaro
raadeving om gesond en lang te kunnen leben, pag. 54, 55.

(*o*) Lib. XXXIV. cap. 2.

Galen recommends to all old men the use of friction with oil in a morning after sleep (*p*), and directs them to continue their accustomed labours, but with less vehemence: and because old men are sensible of the least error in diet, and young men scarcely of the greatest, he directs them to the frequent use of emollient food (*q*).

What medicine.] Such medicines seem only proper for children, as in some degree diminish the quantity of humours: and for this reason it is, that the mildest purges agree so well with them, and particularly rhubarb. Such medicines also in general are serviceable to them, as have a tendency to correct whatever is acid or acrimonious, such as the absorbent powders of crabs-eyes, &c. in like manner whatever may contribute to allay the too easy irritability of the nerves, and at the same time moderately strengthen the solid parts. For which reason it is, that rhubarb, mixed with crabs-eyes and a little cinnamon, proves so beneficial to them.

As they grow in years, be careful not to give such medicines, as by stimulating too much may incite too violent a motion in the humours, lest the tender vessels be thereby broken.

At full growth such medicines are more particularly advantageous, as remove the too great propensity of the humours to an inflammatory spissitude.

But old age, *cum si nihil aliud, quàm siccum & frigidum corporis temperamentum, annorum multitudine proveniens* (*r*), “as it is only a dry and cold temperament “of body proceeding from a great number of years,” requires such applications, as moisten and are lightly nourishing, with the addition of an agreeable stimulus; but then never without somewhat moistening intermixed with them.

What

(*p*) De sanitate tuenda, Lib.V. cap. 3. Charter. Tom.VI. pag. 144.

(*q*) Ibid. cap. 4. Charter. Tom.VI. pag. 146.

(*r*) Ibid. cap. 9. Charter. Tom.VI. pag. 154.

Sect. 55. too strong and rigid VISCERA. 153

What the truth and use, &c.] When medicine was divided into two sects, which had each their followers, some maintained that the art was founded solely on experiments; they admitted manifest causes to be necessary, but maintained that all enquiry about obscure causes and natural actions was needless; and said, that the invention of physick was not preceded by reasoning, but that reasoning was introduced after the art had been discovered; and hence they maintained, that the knowledge of experiments only was necessary; these were called empiricks. The rationalists, on the other hand, did not deny, that experiments also were necessary; but they added, that the knowledge of these could not be obtained in due manner, unless by the use of reason; they farther asserted, that it was necessary to know the several causes which gave rise to diseases, and after this to proceed to the knowledge of such as were more manifest, and in consequence of this they taught, that the knowledge of natural actions, and the internal structure of the parts, was also requisite.

Themison however, one of the rational Physicians, and a follower of Asclepiades, drew up a compendium of this difficult art, wherein he maintained, as did some others after him, that the knowledge of the cause had nothing to do with the cure, and that it was enough to have in view some of the common properties of diseases: whereof he constituted three several kinds, one from astringion, one from laxity, and a third mixed; for that the excretions of the sick were sometimes too little, sometimes too much, and sometimes too little in one part, and too much in another (f).

This was the first origin of the doctrine of astringion and laxity, whereof Prosper Alpinus has since treated so largely in his *Medicina Methodica*; and whereof so much is to be found in Cælius Aurelianus, who was

(f) Vide Celsi præfat. Lib. I.

was likewise himself a follower of the sect of the methodists.

But properly speaking laxity and astringency take place only in the solid parts; nor can the diseases of the humours be well explained thereby, as will hereafter appear. To consider the difference of cohesion therefore in the solids is a matter of great moment in physick; yet all diseases cannot be derived from thence, as the methodists pretended.

Whence the most certain signs are to be taken, &c.] It is proper here to enquire what are the signs, by which we may know, that there is such a cohesion in the solids, as shall neither resist nor yield too much to the distending liquids? When the body does not presently swell, or continue tumid long, after a fuller meal, a larger quantity of drink, or a moist air, we know that the vessels and viscera have their due strength, by which the too great quantity of liquids is presently discharged out of the body. In like manner, if the body of a person grown up does not lessen, by the vessels contracting too strongly and so expelling their liquids, but continues in the same degree of fulness or is but little increased, we know that a due æquilibrium is preserved. Should the body after a large meal presently swell, we know that the vessels are too weak and dilate too easily: if it grows too lean, sapless, and dry, we easily see that the vessels are too strong.

S E C T. LVI.

WE ought now (16), after the most simple diseases of the solids, to treat of wounds; but as these always bring with them the spontaneous disorders of the liquids, these must be first treated of, as requisite to be known, in order to compleat the history of wounds.

Having

Sect. 57. too strong and rigid VISCERA. 155

Having explained the diseases which depend on the too great strength or weakness of the solids, we should treat next of the non-cohesion, or of the dissolution of their unity, as it is phrased : the most simple disease of which kind is a wound, or a solution of the parts just made by the motion of a hard sharp body. But it is well known, that be the wound ever so small, there must be an effusion of humours from the vessels ; that the humours thus extravasated will stagnate, and not obey the laws of the body, but assume, by spontaneous corruption, a very different disposition. Before therefore we can treat of wounds with advantage, we must explain what happens to the extravasated humours.

S E C T. LVIII.

SO that we shall first of all treat of those diseases of the humours, which arise in them spontaneously, when left to themselves, without any consideration of the vessels, or of the vital motion being either raised too high, or grown too torpid.

It is first then to be considered what changes occur in the liquids from the common causes, which act upon all bodies in general. These changes we call spontaneous. Whilst the liquids reside in the vessels, they suffer the action of the body and are changed by it. A spontaneous change alone can never take place in them, whilst the powers of the vessels and viscera are constantly producing in them a very different change. Thus human milk, when drawn out of the body, will turn to whey, cheese, and a fat cream, which it never does whilst in the body.

But the vital motion of the humours through the vessels causes great changes in them, nay induces a quite opposite quality, according as that motion is raised

156 Of the most simple, &c. Sect. 58.
raised too high and rages furiously as in acute diseases,
or languishes and is still as it were, as in chronical
distempers, which opposite effects are therefore ne-
cessary to be examined.

There are three things therefore here to be con-
sidered, 1. What happens to the humours, when out of
their vessels, from the common causes; 2. what
changes arise in them from an increase of their mo-
tion; 3. what consequences follow from the defects
of it.

Of the most simple and spontaneous DISORDERS of the HUMOURS.

S E C T. LVIII.

THE humours found in a living man, are
either such as are crude, or retain the na-
ture of the aliment, or such as, by the power of
the natural functions, and the mixture of hu-
man fluids, have acquired a like nature with
them.

All the humours flowing through our vessels, either
still retain the nature of the food we take down, or by
an intermixture of human liquids, and the motion of
the vessels and viscera, laying aside their own particular
disposition, they are converted into our nature.

Now, so long as the food we take down retains any
thing of its own nature, it is called crude. It is crude
meat and drink therefore which is swallowed. The
chyle is crude in the stomach and intestines, in the
lacteal vessels, in the *cisterna lumbaris*, the chyloferous
duct, the great vein, the right ventricle of the heart,
it is still crude, though it has been already mixed
with so many concocted humours. Whilst it is pas-
sing through the lungs the second concoction begins,
which

which of chyle forms milk: 'till at length the crude chyle, having for some hours sustained the action of the vessels and viscera, especially of the lungs, loses the nature of food, and is assimilated to our humours, and the concoction finished.

And since this concoction requires a pretty long stay in the body, there is almost always something crude, or not perfectly changed, flowing through the vessels with the concocted humours, unless a person has abstained from food for a considerable time.

S E C T. LIX.

THE first mentioned (58) are taken from plants, or other animals.

For our nutriment is taken both from the animal and the vegetable kingdoms; from the fossile we take nothing but some sort of seasoning, such as sea-salt, sal-gem, &c. unless water be also reckoned among the fossils.

Spontaneous DISEASES from an acid HUMOUR.

S E C T. LX.

IF the liquids in us composed either of the mealy plants, or the summer fruits, whether raw or fermented, overcome our vital powers, they will then acquire the same nature within us as they would have done if they had been left to themselves in the same degree of heat. Of which the most common changes are an acid acrimony and glutinous fat. The former from such materials as are both fermented and unfermented,
but

but more especially such as are fermented : the latter from mealy grain or pulse not fermented or boiled ; and under this head may be brought such austere substances as create a tenacity in the humours by their astringency.

An acid is that, which, when applied to the tongue, excites that peculiar taste, which by common consent is called sour (for a taste cannot be described) ; which if held under the nostrils, especially if heated first, produces that smell, which all men call sour. All acids mixed with testaceous powders, the burnt bones of animals, chalk, &c. as also with all alkaline salts, occasion an effervescence. Syrup of violets turns red if mixed with even the mildest acids.

Whatever therefore has the qualities above-recited we call acid.

It is at present much debated, whether such an acid be owing to the aliments only, and the power of the body changes it into what is not acid ; or whether such an acid can naturally exist in the sound liquids of a man or other animals, so that it may be extracted from thence by art ?

Excepting milk, (and perhaps some fat substances) which has not yet entirely acquired an animal nature, and in which the nature of the aliment still prevails, all the other humours left to themselves in the open air will putrify. All animals left to themselves will putrify, unless they be dried by a great heat. By a chemical analysis we can extract volatile alkaline salts from them ; but many even among the most celebrated Chemists deny that an acid can be drawn from them. The blood of a healthy man issuing from the vein has no sign of any acid in it ; sound urine, which washes away the salts of the blood, has no such sign even in those who have taken down a large quantity of acids. And yet has the contrary opinion been maintained by some very eminent men, who have supported their opinion with specious

specious arguments drawn both from reason and experiments.

For though the aliment be changed in the body before it nourishes, it may perhaps not always lay aside all its qualities. The flesh of birds, that live on fishes only, retain the disagreeable fishy taste; and the flesh of black-birds, that feed on buckthorn-berries, is purgative. So that as we eat every day such a quantity of food as is either actually acid or so disposed to be, it seems probable that these may still retain something of their former quality.

Homberg affirms, that he obtained an acid by distillation from the blood of many animals, and even from human blood itself, and, which seems wonderful, that he extracted a liquor from it, which contained both an acid and an alkali separately existing, and not concentered into a natural salt (*a*).

The same Homberg by distillation drew an acid from vipers, snails, flies, ants; and the phosphorus of urine contains a very sharp acid (*b*).

This was next confirmed by Lemery (*c*): who was even of opinion, that an acid still adhered to the volatile salts of animals after they were drawn off by distillation (*d*).

He asserts, that an acid may be easily obtained from the parts of animals, if they be first macerated, so as to let the greatest part of their volatile salt fly off; if a fixed alkaline salt be added to attract the acids, and prevent them from rising with the volatile salt; if in the beginning a moderate fire be used, that the most volatile parts be made to ascend first; and if afterward they be exposed to a strong fire, to drive out the acid which adheres to the earthy part (*e*).

The salts of human liquids, before they are changed by art, approach nearest to the nature of sal ammoniac;

(*a*) Acad. des sciences 1712. Mem. pag. 10 to 19.

(*b*) Acad. des sciences 1712. Mem. 352 to 362.

(*c*) Acad. des sciences 1719. pag. 227—246.

(*d*) Ibid. 1720. 218, &c. (*e*) Ibid. 1720. Mem. 51, 52.

160 Spontaneous DISEASES from Sect. 60.

niac; and sal ammoniac seems to consist of a fixing acid and volatile alkaline salt united together: so that possibly something like this may be the case in the human salts; it would therefore be no wonder, that when the volatile salt was expelled, there should be an acid left in the residuum, which before was united with the volatile salt.

But these salts are produced in the body by the operation of the vessels and viscera. Have therefore these two constituent principles ever existed separately in our humours, and been united afterwards? Or are the acids, which we take down in our food, so changed by the power of the body, as entirely to lose their own nature? Or do they, without losing their own nature, unite with a volatile alkali into a kind of sal-ammoniac? The blood and urine, however, of an healthy man shew no sign of an acid inherent in them.

This at least is absolutely certain, that many vegetable substances, and especially of the mealy kind, the several sorts of grain and pulse, as likewise all the summer fruits, will either acquire an acid acrimony, or be changed into a glutinous fat, if exposed to the same degree of heat, as is found in the body; that the same eaten by a strong healthy person are so changed by the powers of the vessels and viscera, and the mixture of the human liquids, as to lose their own nature and be converted into ours: but when by any accident the body is made too weak to assimilate the aliments, they then follow their own natural disposition, and degenerate into a spontaneous corruption.

The original of an acid, therefore, in the body seems to be owing to the aliments not being sufficiently changed by the action of the body upon them. An acid, therefore, is foreign to the body; for no animal humour, properly so called, ever grows acid of itself.

Now all vegetable substances, whether fermented or unfermented, that grow acid of themselves, may
in

in a body that is weak be also converted into an acid; and all the forementioned mealy substances will at first grow thick with water, and form a glutinous paste, and afterwards turn acid, when fermentation has attenuated that tenacious gluten.

Now the acid thus generated from the aliments in the body is either mild and thoroughly matured, as are most of the acid juices of the summer-fruits when ripe, and as likewise are the acids produced by fermentation from currants, &c. or it has likewise an austere acerbity joined with it, like unripe fruits, or some acid fossils, which by coagulating the humours increase their tenacity.

S E C T. LXI.

THIS acid acrimony (60) has for its antecedent causes, 1. Aliments of the mealy, succulent acid, fresh, crude, fermenting or fermented, parts of vegetables. 2. The want of good blood in the body that takes down the forementioned aliments. 3. The weakness of the fibrous texture of the vessels and viscera (24, 29, 41). 4. The deficiency of animal motion.

Here are enumerated the causes capable of producing an acid in the body; which may be reduced to two classes, being either the aliments degenerating of themselves into an acid acrimony, or such particulars as weaken those powers of the body which should assimilate the aliments into its own nature.

1. Those substances are enumerated first, which supply the material cause for the generation of an acid.

Mealy.] All meal in general has a mild and almost insipid taste; mixed with water it becomes glutinous; by fermentation it changes into a spirituous liquor; by continuing the fermentation it becomes a sharp vinegar.

V O L. I.

M

Succulent

Succulent, &c.] Such are all the juices of the summer-fruits thoroughly ripe (for before they are ripe there is an austere part in them which is not so liable to ferment) (*a*), these juices are either already acid as is the juice of currants, &c. or soon turn acid, after fermentation; the sweet juice of grapes turns to a tartish wine, and by repeating the fermentation to a very sharp vinegar.

Since therefore an acid is the last effect of fermentation, hence the more prone these juices are to ferment, or the more they have been already fermented, the more easily will they produce an acid in weak bodies. The juice of grapes, therefore, when it is newly pressed and is sweet as sugar, inclines least to acidity; it grows more acid, when it begins to be agitated with an intestine motion, and has bubbles perpetually breaking up from it attended with hissing, which is called fermenting; but is most acid when the fermentation is over and it is become wine. Weak men, when they drink wine, fall presently into four belchings, unless the wine be oily and very strong, and not easily apt to change.

Now follow the efficient causes.

2. All the actions of the vessels and viscera conspire to change aliment into our nature, and this partly by the action of the vessels, and partly by the mixture of fluids already assimilated. Good blood contains in it materially all the other humours, bile, spittle, &c. which humours being secreted from the blood follow the nature of the blood, which is good, when it consists of assimilated humours, and crude, when the aliments still retain some part of their own nature. If there be a deficiency of good blood therefore, the principal power is wanting, which is required to change the aliment into our nature. See §. 25. numb. 1.

3. These have been discoursed of already in the forecited places, and there it was shewn, how much the

(*a*) H. Boërhaave Chem. Tom. II. pag. 172.

the strength of the solids contributed to the concoction of the food. So that acid and acescent food (*i. e.* such as is not yet acid, but disposed to become so) disagrees very much with such persons as are of a lax habit of body; but in hot countries, where the habit of body is in a contrary state, acids are both pleasant, and agree very well. When the Roman soldiers made war in hot countries, their common drink was vinegar mixed with water, which they called *Posca* (*a*).

4. The chyle, which is prepared by the viscera designed for this purpose, is mixed with the blood in small quantities, and flowing with it is changed by the operation of the vessels and viscera into milk, and after some hours altering its nature is turned into blood. This is wrought by means of the circulation, and chiefly by the action of the lungs. But the more any one exercises his body by muscular motion, the swifter is the motion of the humours through the vessels, and the stronger and quicker is the respiration; and of course the assimilation of the aliment is in this case both more speedily and more easily performed. A hardy plowman, who feeds upon coarse bread that is already sour, is very well after it; but let a weak man eat of it and it shall turn to a corroding acid, and bring on a most troublesome heart-burn. For which reason diseases from an acid are so common to young infants, who are scarce able to move much their little weak bodies: but as they grow older, run about briskly, and are seldom or never at rest, they become less liable to these diseases.

S E C T. LXII.

THE seat of this disorder is principally in the parts where the first digestion is performed, from whence it by more slow degrees infects the blood, and at last all the humours.

M 2

The

(b) Nonnius de re cibaria, Lib. IV. cap. 15. pag. 479.

The parts where the first digestion, &c.] All the changes that happen to the aliment by manducation, the actions of the stomach, intestines, lacteal vessels, glands of the mesentery, and chyliferous duct, 'till the chyle is discharged into the subclavian vein, is called the first digestion. All the vessels and viscera, which pour their liquors into any part of this tract, belong to the first digestion. The effect of this first digestion is the production of chyle; and chyle always retains something of the nature of the aliment. But in the second digestion (whose effect is sanguification) whatever is of a foreign nature is entirely thrown off, and the aliment at length changed into our own. Since therefore an acid is something foreign to the body, and owes its origin to the food we take down, it will more easily be generated in those places where the crude humours still retain something of the nature of the aliments, and more difficultly where the aliments are assimilated to our humours.

The blood by more slow degrees.] Nor does this seem possible 'till every part concerned in the first digestion be replete with acid. The very little mouths of the lacteal vessels and meseraick veins will not easily admit any thing that is acrid; for those most tender orifices would presently be contracted by it: And then the chyle is diluted in the thoracick duct with a very large quantity of lymph; and thus diluted with so many humours, it enters the subclavian vein in very small quantities; and is then immediately carried away with the torrent of blood, and is no longer to be distinguished. So that if there were some slight acid in the chyle, yet so diluted it would not be discernible. But the chyle flowing with the blood is soon separated from it by the breasts, and produces milk; which, when fresh drawn, was never perhaps known to be acid; and yet left to itself in the heat of the common air, after it is drawn, it will turn sour. Though I am persuaded no one will presume to affirm,

firm, that milk was ever found to be drawn four from the breasts of the weakest woman.

Since milk therefore, which falls far short of the perfection of blood, is very seldom or never found acid, the blood itself will much more difficultly receive an acid taint; and yet that it may do so, we have reason to believe from what is sometimes observed in diseases.

Thus the sweat in languid diseases has been sometimes observed to have an acid smell; and sometimes even at the close of acute diseases too.

The drinking too freely of wines disposed to be sharp has brought on the gout, which has been often cured by the sparing and repeated use of alkaline remedies.

The black feculent blood that sometimes is lodged in the hypochondria, when resolved, moved, and excreted by vomit, has sometimes been found very acid; so as to erode even stones, and cause a very violent effervescence when intermixed with earthy bodies.

Bones infused in acids will grow soft and flexible; many sorts of aliments are disposed to be sharp, whose nature is changed in a sound body; but if the changing power be too weak, and this tendency to acidity in the aliments is not conquered; the bones, cartilages, &c. will sometimes become flexible, as in the case of rickety children (a).

S E C T. LXIII.

IT produces four belchings, hunger, heart-burning, iliac pains, flatulencies, inactivity in the bile, and the several changes which it is subject to, acid chyle, and excrements with a sour smell. These are its effects in the stomach and intestines.

M 3

Sour

(a) Boërhaave Chem. Tom. I. pag. 737.

Sour belchings.] Belching is the explosion of some elastick matter, compressed by the convulsive constriction of the fibres of the gullet and stomach, and now released; and when an acid predominates in the stomach and intestines, the belching must of consequence be sour.

Hunger.] Hunger depends on a great variety of causes, among which are reckoned all stimulants, and acids in particular. But it is a great mistake, that acids only excite an appetite, as Helmont thought (a).

Bile.] The juice of wormwood, &c. excites a languid appetite; hunger, indeed, often proceeds from an acid, but not always. This we learn from the most rapacious animals, that live on animals only, whose stomachs have never any acid in them, and yet they are most voracious. Infants labouring under diseases proceeding from an acid, have oftentimes a strong appetite, and the nurse wonders, that eating so greedily, the child should not thrive.

Heart-burning] It is a very sharp pain felt under the *cartilago eniformis*, in the place usually called the pit of the stomach. The Antients named this disease *καρδιαλγία*, *καρδιογμῶς*, the heart-burning, because they assigned to the mouth of the stomach the appellation of *καρδία*, or heart, as Galen proves from Nicander, Thucydides, and Hippocrates (b). In another place he also observes (c), *quod nulla pars tam accuratum habeat sensum, nec utrumque principium una secum afficiat, ut os ventriculi, & vulgo & Medicis stomachus dictus; dum per nervos adeo magnos cerebrum, situs vicinia cor, afficit;* “that no part has so delicate a sense, or affects the
“two principal parts of the body, so much as the
“mouth of the stomach; for by its nerves, which
“are so large, it affects the brain, and the heart by
“the nearness of its situation.”

For

(a) Pag. 164. 24. (b) De Hippocr. & Platon. placitis, Lib. II. cap. 8. Charter. Tom. V. pag. 108. & Comment. in Lib. II. Epidem. Charter. Tom. IX. pag. 124. (c) De symptom. causis, Lib. I. cap. 7. Charter. Tom. VII. pag. 57, 60.

For the stomach itself seems not so sensible, as its upper orifice : for while an acid lies quiet in the stomach it causes no pain : but as soon as by belching it is thrown upwards, or by the motion and different position of the body it falls upon the upper orifice ; presently then comes on this most disagreeable pain, this heart-burning may be not only from an acid, but from any other acrimony irritating the *cardia* or mouth of the stomach.

Iliac pains.] The acid being thus produced in the stomach, if it be not changed by the bile from the heat and delay it makes in the intestinal tube, shall grow more acid still, and hence may cause excessive pains by eroding and vellificating its fibres ; whence gripings in the belly are so frequent to children.

Flatulency, spasms.] Whilst the air is unconfined in the stomach and intestines it does no hurt : but it appears by experiments made on living animals, that if the intestine be touched, v. g. with spirit of vitriol in any place, it is immediately drawn together with a strong spasm : if it be touched again in another place, at a small distance, it is constricted thereto : and presently the intermediate part of the intestine is inflated by the rarefaction of the air within. When therefore an acid by its irritation produces spasms in the intestines, by which they are contracted in several places, the air within rarefies and distends them, and when the spasm is relaxed, it passes upward or downward with violence ; or else shifting its place only, it wanders through the intestines with a murmur called borborygmos or rumbling of the guts. Add to this, that every thing in fermenting generates elastick matter very copiously. So that the cause why flatulency arises from an acid is two-fold ; from the irritation, by which the fibres of the intestines being drawn into a spasm keep in the included air ; and from the elastick matter, which is generated in all liquids that are apt to ferment ; on both which accounts those who suffer under an acid are so subject to flatulencies.

Inertness in the bile.] As soon as the chyle passes through the pylorus into the duodenum, it is mixed with both sorts of bile, which contribute very much to the changing the foreign humour into natural. But of all the humours that are not excrementitious, the bile is the most acrid, and soonest liable to putrefy: and for this reason it is, that dead bodies soonest putrefy near the liver. This therefore mixing with the chyle oftentimes destroys the too great tendency it has to sharpness, divides and dissolves whatever it meets in its way, and disposes it to an equable mixture. Thus beer and ale are corrected with hops, which is a very bitter plant, and nearly resembling bile, that they may not grow sour. In all cases therefore, where the bile predominates, the nature of the bile is in a manner inverted, and its efficacy rendered almost fruitless. This is seen in the case of infants labouring under an acid; for the milk in their stomachs turns to a curd not unlike to cheese, which is dissolved by the bile, whilst it is in a good state, and then the stools will appear yellow, and alike in all parts; but if the effect of the bile is overcome by the prevailing power of the acid, white lumps of this cheese-like curd will be discharged at the same time with the stools.

If the bile of other animals be somewhat inspissated, then made into pills, and given in a small quantity every day, it would prove an exceeding good remedy in this case. The stability of health depends very much upon a due state of the bile: for if it abounds or is too acrid, putrid diseases will follow; and chronic, if it is deficient or rendered incapable of action; many of these diseases take their rise from a bad digestion in the first offices, and destroy the health by slowly corrupting the humours.

Its various changes.] Whilst infants are well, the stools are yellow and in all parts alike: when an acid begins to prevail, the stools are yellow indeed at first, but after they are exposed to the air will within half
an

an hour turn green: as the disease increaseth, they are green at first, and indeed sometimes of so deep a colour, that like copperas they will stain the linen, so as hardly to be washed out. For which reason the quantity and acrimony of the acid in infants may be judged of from the colour of their stools.

It is true indeed, that such æruginous bile may proceed from other causes, as shall be shewn in another place; but in this tender age it almost wholly arises from a prevailing acid.

Acid chyle, stools smelling sour.] If the stomach and intestines be thus full of acid, then also the chyle may be acid too, as is very evident; but in this case it cannot easily enter the very little mouths of the lacteals, as they are contracted by every thing that is acid. At length the stools also will smell sour, as is often observed in infants, which shew that the several viscera employed in the office of the first digestion abounds with an acid; and at the same time points out the great danger there is in the case.

S E C T. LXIV.

IN the blood it produces paleness, a chylous acid serum; hence in women, acid, or rather too ascescent, milk, acid sweat, acid spittle; from whence come itchings, obstructions, pustules, ulcers, too speedy coagulations of the milk, and perhaps of the blood itself, and an unsuitness to circulate, irritation of the brain and nerves; whence convulsions, an interrupted circulation, and death.

Paleness.] All persons that have a predominant acid look pale; as appears in infants, girls, and men of a lax habit. This shews the deficiency of the most solid red part of the blood; and where this
 † fails,

fails, the assimilation of the crude humours is never carried on so well as it ought to be, and they more easily degenerate into a spontaneous corruption. Paleness therefore is to be considered not only as the effect of a present acid, but also as the preface of a future acid, through the weakness of the assimilating powers. Besides, acids taken inwardly seem to bring on a paleness; thus vinegar applied to the lips will make them look pale. Such persons, as are employed in making vinegar of wine or beer, from being daily conversant in an air replete with acid vapours, are oftentimes observed to grow pale.

A chylous acid serum.] This must be distinguished from the concocted serum of the blood, which is yellow, concretes by the fire, and is never found to be acid or acescent; but is apt to putrefy when left to itself. By the chylous serum is here meant the chyle itself, when not sufficiently subdued by the powers of the body while it is circulating with the blood; so that it retains its own nature too long, by which it inclines to acidity: for from the chyle circulating with the blood is generated milk, and this milk, by the efficacy of the circulation, when continued for four and twenty hours, will be changed into serum and red blood; but if this changing power be too weak, it will either not alter the nature of the milk, or at least not so soon: and consequently the sharp dissolution of the milk may remain, and an acid be produced even in the blood itself.

Hence in women an acid, or rather too acescent, milk.] Milk is seldom or never observed to be acid in the breasts; but it may be easily in such a state as to be capable of turning acid very soon. If an healthy woman shall abstain from eating or drinking for four and twenty hours, she will have no milk in her breast, but a kind of yellowish salt serum, which the child will dislike. And the reason is, because all the milk is at this time changed by the laws of circulation into a serum, and become a natural humour. If now these

these changing powers be too weak, the milk will retain its disposition to turn sour so much the longer; so that it will become acid the sooner, the less it is digested. But this depends upon the strength of the body, and the time the milk continues in the vessels wherein it flows with the blood; and hence it appears why milk turns sour sooner, that is drawn from the breast soon after eating, or from the breasts of a weak nurse.

Acid sweat and acid saliva.] This circumstance is less frequent, and never occurs but in very weak people; yet it is plain, that if the blood may have an acid in it, all the humours secreted from it may have an acid also.

Itching.] We see that all sharp humours, when they arrive at the skin, will occasion itchings, obstructions between the scales of the skin, pustules, &c. in the jaundice the bile, when carried to the surface of the body, shall often raise an intolerable itching. If the humours infected with an acid acrimony flow to the same part, the same effect will be produced. By eating unripe and crabbed fruits the children of country-people often labour under diseases of the skin attended with a most violent itching. In the first stage of life infants are often afflicted with surprising erosions of the skin.

Too speedy coagulations of the milk.] If the milk incline too much to acidity, and stagnate in the lactiferous receptacles of the breasts, it may possibly turn acid there; a thin serum will in this case separate from the curdled part and flow through the nipple, whilst the thick part left behind may possibly occasion hard tumours, inflammations, &c. And yet inflammations from a coagulated milk in the breast are much more frequent after a fever than before; and then it is rather an alcalescent degeneration. *Fortè centies Medici observant, lac coagulari sic à febre, ubi ne semel id videtur factum ab acido* (a); "Physicians perhaps shall see
" milk

(a) H. Boerhaave Chem. Part II. pag. 393.

“milk thus coagulated by a fever an hundred times together, and it may be not once coagulated by an acid.”

Coagulations also of the blood itself.] The strongest fossile acids coagulate the blood: the milder vegetables rather dilute it: hence probably it very seldom happens that an acid generated in the body can coagulate the blood; yet if the *artra bilis*, which, as the Antients observed, is sometimes so acid as to ferment with earth, and erode stones like *aqua fortis*, be mixed with the blood, it may certainly cause a fatal coagulation of it.

Irritations of the brain and nerves.] it is certain, that if any thing acrid could possibly touch the tender fabrick of the brain and nerves, all the functions that depend thereon would be disturbed. Such acrid things can seldom arrive at these minute vessels. Nature has been solicitously careful to prevent their admission by faithful guards in every part. Men swallow the most acrid substance without prejudice, which would destroy the brain, if they could be carried thither. If the least quantity of smoke but fall upon the eye, the eye-lids presently close; or if it be drawn up by the nose, what a violent sneezing will it bring on; if sucked into the lungs, a cough shall ensue to expel this enemy; or if an acid be thrown into the stomach and intestines, excessive vomiting and fluxes shall follow, &c.

And whatever part the acrid matter be in, almost all the humours of the body are brought thither from their own seats to wash it away; and when we see a law thus takes place in all the greater organs, we have good reason to think it does so in all the less. It is certain the cortex of the brain, separated from all its blood vessels, has a very insipid taste, and applied to the eye gives no pain. Hence acids cannot so easily enter the least vessels, as many have thought; but it seems to be for another reason, that irritations of the brain and nerves, with numberless other mischiefs following

lowing thence, may arise from an acid in the *primæ viæ*; for the nerves that are dispersed through the stomach and intestines have a surprising dominion over every part of the body, as we learn by certain experience. If a worm by its creeping irritates these parts, it shall often occasion convulsions: an hernia pent up shall often cause sudden death, and even before this circumstance happens shall sometimes bring on all the symptoms of a disordered brain. Atra bilis in these viscera will strangely overset the whole mind: poisons swallowed, and still remaining in the stomach, shall disturb the frame of the whole body, 'till death ensues: opium, as soon as taken, and whilst it continues in the stomach almost undissolved, shall appease every pain, and stop too violent evacuations, &c. hence an acid, when formed in the offices of the first digestion, may possibly cause wonderful diseases, and even death itself, by the irritation only of the nerves; nor is it requisite to produce this effect, that the acid should mix with the blood, and so enter into the inside of the brain and the nerves. Though this is most likely to be the case at that age, when the whole system of the nerves is most moveable: for which reason infants are so frequently convulsed, when labouring under an acid.

S E C T. LXV.

FROM what has been said (60, 61, 62, 63, 64, 65) we may easily learn, when this acid temperament is present, future, or past; from hence also its effects may be foreseen; and its cure easily known.

The present acidity is known by a paleness of colour in the corners of the eyes, the inside of the mouth, the jaws; the lips; by four belchings; little or no thirst; coldness and laxity of the whole body;
by

174 Spontaneous DISEASES from Sect. 66.
by the stools smelling sour; the urine looking white like water; the appetite being generally large.

Future.] If the Physician knows the habit to be weak and lax, and blood dissolved, the course of life unactive, or a great loss of blood to have preceded, and then that such diet has been used, as spontaneously degenerates into an acid acrimony; he may safely foretel the speedy generation of it in such a body, as he sees these two particulars joined together, an acid diet, and powers too weak to correct it.

The past will be easily understood from what has been said.

Its effects.] Which will be various, as has been mentioned, according as the acid taint infects either the *primæ viæ* only or the blood itself too: and again, where we observe the effects of a predominant acid, there we may know it to be present.

From all which the requisites to a cure easily appear.

S E T T. LXVI.

WHICH is to be affected: 1. By aliments both animal and vegetable that are of a nature opposite to an acid. 2. By juices as nearly resembling good blood as it is possible, such as those of birds of prey. 3. By strengthening things. 4. By strong motion. 5. By medicines that absorb, dilute, blunt, and change, acids.

If all diseases were from acids, as a certain sect of Physicians have held, the art of physick would be a very short one. For if a man laboured under the worst degree of this disease, he might be cured I think in a few days, provided his viscera were sound; and this by diet only without medicines, if he lived only on flesh or fish or broths, and drank only water.

1. No animal tends to acidity of itself, but always to putrefaction. All food therefore of the animal kind is opposite to an acid: but roasted flesh is more especially so: fish is particularly good in this case, because it putrefies much sooner than flesh: especially such kinds of fish as devour other fishes, such as pike, &c. Broth also and jellies must be serviceable in this case; for even the jelly of hartshorn will putrefy in the summer-time in two days.

Vegetables.] Most vegetables incline to an acid, yet not all. All bitter vegetables resist acidity; and for this reason they preserve beer, by infusing these in it, from growing sour. Almost all the kinds of cabbage putrefy of themselves; and the decoction of cabbage hath certainly something of a subputrid stink: all the acrid antiscorbutick plants putrefy and will not ferment, such as the scurvy-grass, horse-raddish, mustard, &c, nay when distilled fresh they yield a volatile alkaline salt; which makes them so useful in cold scorbutick diseases, since they both resist acids, and excite the languid functions by their powerful stimulus.

And drink only water.] For all beer will turn sour. Or if the patient's weakness requires wine, use a strong oily sort, such as Spanish, Hungarian, or Canary, wines, and give some absorbent thing after it to destroy its acidity.

2. In the *materia medica* you have a catalogue of those birds that live on other animals, whose flesh therefore is most liable to putrefy. An ox feeds only on grass, has flesh consisting only of grass changed by the powers of the body; the flesh of that animal therefore approaches in some measure to the nature of vegetables. But when fowls live on a food that is originally animal, their nourishment partakes of an animal nature, which is still farther perfected in the body that swallows it, and for this cause it is, that such birds as live on other animals have that high relish: nor can any man live on them long without using acid sauces or salt; so apt are they to putrefy.

Three

Three things are required to cure the prevalence of an acid in the body: 1st, such food, as is never naturally changed into an acid, but is apt to assume a quite opposite nature, of which we have already treated in the two first numbers of this paragraph; 2^{dly}, The actions of the body, which assimilate the food we eat into our nature, are to be excited and strengthened; 3^{dly}, The acid, that is already in the body, and if care be not taken will do mischief, is to be corrected and rendered inaeffectual, and this we shall learn to do from the last number of this paragraph.

3. These corroborants have been treated of numb.

4. §. 28. the austere acids often destroy acids in the body, not by the mixture of their substance, but by means of the last effect, whereby they strengthen the actions of the vessels and viscera. Yet those are to be preferred generally, which have a strengthening power without an acid. Brunswick mum excels the rest. This is a syrup of wheat as it were, and abides the excessive heats of India without a change, and in all languid diseases is more serviceable than could almost be expected: so likewise all wines, but especially such as are oily and strong, are anti-acids, as they strengthen and increase motion; and particularly if any spicy stimulating ingredients be added to them.

4. What exercise does to strengthen a lax body has already been observed §. 28. numb. 2. hereby likewise the action of the vessels and viscera is increased, by which the aliment is changed into the nature of our humours, which always tend to putrefaction. By violent exercise the urine becomes more acrid, and emits somewhat of a putrid smell; the sweat looks yellow and smells strong; and the body is even disposed to fall into acute putrid diseases through an excess of labour. Physicians often wonder, that when the acid has been subdued in the best manner that was possible, yet that the person thus reduced should be apt to fall back into the same diseases again. But the reason is for the most part, because they neglect to strengthen

strengthen the body by exercise: for the disease certainly returns, unless the muscular motion be increased, or its defect supplied by strong frictions. Thus we see country-people, who live on four rye-bread and butter-milk, &c. shall conquer it by hard labour, and find no disservice from it.

5. Medicines that absorb acids.] The chief of these are enumerated in the *materia medica*. These are such medicines as have the peculiar property of attracting a latent acid, of separating it from the other parts of a liquid, and in a manner uniting into one mass with it.

Upon very pure spirit of vinegar I poured by degrees the powder of crabs eyes; this was followed with an hissing and an effervescence, and the powder seemed to be dissolved; yet so as that when this effervescence was over, a considerable number of flocculent parts separated from the liquid, and fell by degrees to the bottom; upon moving the vessel these parts however were equally mingled again with the liquor which swam above them. I proceeded to add more powder 'till it fell to the bottom undissolved, and there remained no more sign of any effervescence. I then filtrated the liquor, and found it somewhat acid to the taste, and yet when mixed with syrup of violets it made no change in its colour. This clear liquor I put into a tall cucurbit, and placing an alembick upon it, I distilled it with a very gentle fire, and found that it yielded a considerable quantity of burning spirit, which had not the least sign of any acid in it. After this spirit, by increasing the fire, I obtained a water, which by its smell and taste I suspected to be somewhat acid; yet it changed not the syrup of violets red; nor caused any effervescence when mixed with oil of tartar *per deliquium*, nor wrought any change in a solution of the *mercurius sublimatus corrosivus* made in pure water. I proceeded to inspissate the remaining liquid 'till it was almost dry: its taste was then salt and inclined to be bitter: I concluded

therefore that the acid of vinegar resided in this residuum united with the powder of crabs-eyes. To this I then added a stronger acid, *i. e.* oil of vitriol, that I might divert the acid of the vinegar from adhering to the crabs-eyes; and then distilling it out of perfectly clean vessels with the most gentle fire, I obtained a very acid spirit extremely volatile, and of a most penetrating smell.

Since therefore the production of vinegar seems to depend on the combination of a burning spirit with a more fixed acid, which lay concealed in the wine (*a*); it is plain from the foregoing experiment, that crabs-eyes have a power to separate the acid from the other parts of the vinegar, and unite with it in such a manner, as that whilst that union lasts, it shall no longer act as an acid.

Hence appears that usefulness of absorbent powders. For these seem to be in a manner torpid of themselves, and active only when they meet with an acid; in the mean time they offend not the body by any acrimony of their own.

One thing only remains to be observed, that in the shops it is customary to grind these ingredients on a marble to an impalpable powder, in order to make them mix more equally with a liquid, and to hinder them from feeling gritty in a disagreeable manner between the teeth: but then they get a new quality of running into concretions with meer water, and much more with the glutinous humours, which may occur in the *primæ viæ*; and then if there be not acid enough present to dissolve them, they will form masses which cannot easily afterwards be resolved, but will offend both by their size and weight.

It appears not from any observation, that the most costly pearls are preferable for this use to common crabs-eyes.

This action of all absorbents, whereby they destroy
acids,

(a) Boërhaave Chem. Part II. pag. 214.

acids, seems to take place only in the viscera wherein the first digestion is performed.

Medicines that dilute.] That is water and every other liquid in which water is the prevailing ingredient. Oil of vitriol burns every part of the body that it touches; and yet if diluted with a great quantity of water it shall do no hurt. But as an acid commonly prevails in weak bodies, and water diluents tend to make them weaker, (see §. 35. numb. 1, 3.) and weakness has been assigned as one cause of producing an acid in the body: (see §. 61. numb. 3.) the absorbent medicines for this reason are to be preferred to the diluent.

Medicines that blunt.] These are such medicines, as by their soft and oily particles in particular so case up every thing that is acrid as to make it inactive; and at the same time defend all the parts of the body, which they cover, from erosion. When the Surgeons attempt to erode any part with the *lapis infernalis*, or corrosive mercury sublimite, which has the most concentrated acid joined to the metal, they defend the parts adjacent by covering them with some fat or oily substance. If acrid poison has been swallowed, there can be no better application than to drink a large quantity of oil. That most sharp acid of vitriol if united to oil is converted into a mild sulphur; which though almost insipid, still contains within it that corrosive acid. And for this reason it is, that very soft oils are so beneficial to infants who labour under an acid. And yet they have this inconvenience attending them, that they are apt to weaken the tone of the solid parts. (See §. 35. numb. 3.)

Broths also made from the parts of animals, inspissated into jellies, are here also beneficial, as they inviscate acids by their glutinosity, and are always naturally disposed to putrefaction.

Medicines that change.] These are such medicines, as meeting an acid unite with it into a new kind of salt, that is neither acid nor alcali, but what the Chemists

call a neutral and compound salt, which is one of the best kinds of resolvents. When the acrid liquor of salt of tartar *per deliquium* is mixed with the very acid oil of vitriol, a mild compound salt is produced, called in the shops vitriolated tartar, which is one of the best deobstruents we have.

Such are also all the fixed alkaline salts drawn from a lixivium of the ashes of vegetables: as also all the volatile salts of animals and vegetables. To this class may be reduced also all soaps, made of oil and an alkaline salt; whether fixed or volatile.

S E C T. LXVII.

WHEREOF the choice, preparation, dose, and seasonable application, will be known to the Physician from his knowledge of the disease, its seat, the patient, &c.

The choice.] Of the remedies recited in the foregoing paragraph, those are to be preferred, which are most agreeable to the various nature and seat of the disease, and the different disposition of the patient. We seldom give alkaline salts fixed or volatile to young children, or at least in a very small quantity: because unless they presently meet the acid, they may do as much mischief by their acrimony as the acid itself. But we give them absorbents, which have no acrimony to be of prejudice, or soaps, in which the acrimony of the alkali is so inviscated by oil as to be incapable of doing harm. In the mean while they resist acids most powerfully. If the stomach or intestines be excoriated by the erosion of an acid, we fly to oily medicines and animal jellies. If beside the acid there be a glutinous lentor in the *primæ viæ*, which would make the absorbent powders useless; we have recourse to the fixed alkaline salts, which will divide that glutinous visciditv, and change the acid in-

to a neutral salt. If the acid taint hath at last infected the blood, causing cold and sluggishness, as is commonly the case: the volatile alkaline salts are of service, as they likewise excite the languid power of life by their stimulating property. Fixed alkaline salts are likewise serviceable, as they seem capable of entering the blood by being diluted by the chyle. The use of absorbents is less proper, as they do not seem so capable of entering the lacteal vessels. But if you would strengthen the body at the same time, filings of steel are to be preferred to every other medicine.

Preparation.] The alkaline salts, whether fixed or volatile, are best given diluted in pure water. If there is reason to apprehend that a troublesome flatulence should follow upon the meeting of the alkali and acid, it is most adviseable to give an alkali boiled up with oil into a soap. Nor should the absorbents be too finely powdered, as we have already observed. There is in some shops also another preparation of the absorbents, which in my opinion seems to be of little use, made by dissolving these powders in distilled vinegar, and then precipitating them with oil of tartar *per deliquium*; this precipitate powder is washed, preserved, and called a magistery. I have found the magistery of crabs-eyes thus prepared to be only a very fine powder, which raises an effervescence, and dissolves in distilled vinegar, as before. This labour therefore is of no benefit: nor is it true, as some have said, that these magisteries will not again arise into an effervescence with acids.

Dose.] As to the absorbents one hardly can err, they being safely given in a large dose, and not active enough to do any harm. Nor is there need of great caution as to the diluents and obtundents. But as the ingredients that change acids are all acrid, they require a more limited dose, as is observed in the *materia medica*.

Seasonable application.] If there be an acid in the *primæ viæ*, it is best to carry the anti-acids through the whole tract of the intestines, by adding to them some light purging stimulus. If it be in the blood, the volatile alkaline salts are particularly serviceable, especially if the body is hereby disposed to sweat at the same time.

If a child at the breast labours under an acid, we may weaken and destroy the present acid; but we cannot give it an alcaliscent diet, as it loaths almost every thing but milk. It is proper therefore to order the mother such a diet as will make the chyle and milk assume a nature most remote from an acid. For this see §. 96. numb. 1, 2, 3, 4.

S E C T. LXVIII.

HENCE it appears why this disease is so common to children, to the slothful, to virgins, to the poor, and to certain tradesmen.

Why to infants.] These live almost entirely upon the milk of their mothers, or on mixtures of mealy substances with water, bread, and the milk of other animals; their solids are very tender; and they have scarce any exercise.

The slothful.] The actions of all the vessels and viscera are weakened by living in ease and idleness without exercise; the aliment is not assimilated, but degenerates into a spontaneous corruption; and as the greatest part of the food we take down is capable of turning sour, such as bread, beer, wine, and many kinds of herbs; it is no wonder that such persons abound with acids.

To virgins.] Because they have a more lax habit of body, and are too much given to a sedentary life, if they be of the richer sort; and those that are poor get their living by some sedentary work, and delight

Sect. 69. an acid HUMOUR. 183
too much in drinking warm tea, &c. at least in this country.

The poor.] Because they can seldom eat flesh in this country, and live chiefly on milk-meats, butter-milk, barley, oats, buck-wheat, rice and herbs, and small beer : many of them get their living by some sedentary trade, or some business at least which does not require a strong motion.

Why to certain tradesmen.] Such persons, as are obliged by their trade to spend whole days in an air full of acid fumes, generally labour under this disease. For the bibulous veins, which cover the whole surface of the body, absorb a considerable quantity from this air ; the same air is drawn into the lungs, and passes through the stomach and intestines ; so that the whole body is at length filled as it were with an acid. For this reason we so frequently see those, whose business it is to make beer, vinegar, aqua-fortis, &c. look pale, languid, and swelled ; so large a quantity of acid entering the body every day, as cannot be conquered by its strength and motion.

DISEASES from a spontaneous GLUTEN.

S E C T. LXIX.

A Glutinous fat from vegetables has these antecedent causes, 1. mealy substances, crude, crabbed, and unripe, fruits. 2. A want of good blood. 3. Weakness of the vessels, the viscera, and bile. 4. A defect of animal motion. 5. A dissipation of the more liquid part through too great a relaxation of the secreting vessels. 6. The retention of the thicker part through the weakness of the excreting instruments.

As many Physicians have deduced almost all diseases from an acid, so have others from a pituitous matter. This they have found fault with on all occasions, have insisted upon its being extirpated at all times, though many and very difficult diseases frequently arise from the want of it.

By a glutinous body we mean a substance, which in some sort approaches to the nature of a fluid, but whose parts cohere with so much tenacity, as to admit of being drawn into threads. A glutinous substance therefore is as it were of a semiliquid nature, but has such a lentor in its parts, that when moved they in a manner still stick together.

There is a lentor in all the human liquids, except perhaps in those that are most subtle, and some that are excrementitious; the blood and its serum, the bile, spittle, &c. have a certain tenacity, which is requisite to health: as soon as the blood loses this plastick lentor, and become too thin, a dropisy will follow.

But there are some liquids secreted from the blood, which have a very good right to be called glutinous, v. g. the unctious liquor that serves to lubricate the joints; the natural mucus that defends and lubricates most of the membranous parts, as in the gullet, stomach, and intestines: the inside of the arteries too are lined with such a mucous covering.

For which reason every thing glutinous is not to be condemned as though it were morbid; since a pituitous substance by the laws of the body may be produced in the most perfect health, and be attended with such good uses.

In this chapter therefore we shall treat of that morbid gluten, which owes its rise either to the aliments being of too glutinous and tenacious a nature; or to an excess in the natural pituita, either as to its quantity or its tenacity.

The Ancients supposed the pituita to be two-fold; the one burnt as it were and too much concocted, called *phelgm*, (ἀπὸ τοῦ σιφαιχθαι, which signifies *burnt*)
and

and the other of a white colour, by all termed *pituita*, and by Prodicus termed *βλῖνα*, or *mucus*, in his treatise of the nature of man (a).

The former was an hot phlegm, and called phlegma phlegmonodes: the latter was a cold thick humour, and called simply *pituita*, or cold phlegm.

The hot phlegm often appears in blood drawn from the veins in inflammatory diseases, where its surface is covered with a white tenacious covering resembling leather; cold phlegm is what is secreted so largely in catarrhs.

Now then we are to consider the causes, which from the forementioned particulars may occasion the production of too great accumulation of pituitous matter in a sound body.

1. All mealy substances mixed with water grow thick more or less. Starch, which is a very fine powder, becomes glutinous, as every body knows. The flower of linseed mixed with water forms a most tenacious paste, which cannot be digested, as has been already observed §. 25. numb. 1. And this more especially holds good, if these substances are taken crude: for after fermentation, though it be slight and inconsiderable, the tenacity is broken, as is plain from bread. And this is the cause of the many diseases which prevail among the poor, as they live almost wholly on mealy substances crude, and in the mean time do for the most part get their living by a sedentary trade.

Crabbed unripe fruits.] These have the power of drawing the elementary particles nearer together, and giving a greater lentor to the fluids. Let but any one taste of an unripe medlar, and he will straight feel the whole inside of his mouth parched and contracted, and the spittle inspissated. And if the like crabbed substances be swallowed, they will operate in a resembling manner in the stomach and intestines.

The

(a) Galen. de natural. facultat. Lib. II. cap. 9. Charter. Tom. V. pag. 50.

The children of country-people eat greedily of unripe fruits, and generally suffer for it by a swelled belly, a pale face, and a languor of the whole body.

2. A due quantity of good blood was justly reckoned among the causes that change the aliments into our humours, as has been shewn §. 25. numb. 1. and §. 43. numb. 3. where this is wanting the glutinous aliment retains its own nature, and is not thoroughly changed. Such persons as have lost too large a quantity of blood grow tumid, and languish under a cold lentor: for good blood attenuates all viscidities by its motion and heat. Hippocrates has a remarkable passage that confirms this truth (*b*); he says, *cum in utero gerat mulier, tota fit cum virore pallida*, (χλωρή) *quod purus ipsius sanguis quotidie ex corpore destillet, & ad fœtum feratur, illique incrementum fiat, & pauciori in corpore sanguine existente, eam ex viridi pallidam esse necesse est*; "when a woman is with child, she becomes pale and green, (χλωρή) because her good blood passes from her every day, and is spent on the growth of the fœtus; having less blood in her body therefore, she must of necessity look pale and greenish."

3. The due strength of the vessels and viscera changes the crude aliment into the nature of our own humours; if increased it causes the hot viscosity or phlogistick disposition in the blood, which is the very reverse of that pituitous viscosity we are speaking of. For which reason such as are robust, and use hard labour, may live upon a mealy diet without prejudice; while the weak and the idle have the viscera of the abdomen immediately obstructed by it.

The bile.] The bile is secreted from the venal blood of the abdominal viscera by the liver; it is poured into the duodenum, and mixes with the chyle as soon as it comes out of the stomach; by its soapy nature it dissolves the aliment, disposes it to an uniform mixture,

(*b*) De mulierum morbis, Lib. I. cap. 32. Charter. Tom. VII. pag. 743.

ture, and divides and attenuates whatever is glutinous or viscid. Calves feed only on milk, this milk in their first stomach is turned into curds and whey: this curd in the second and third stomach grows by degrees more cohesive and thick; in the fourth stomach it has scarce any juice left: but when it passes into the duodenum, and the bile comes to be mixed with it, it is all entirely dissolved; so great is the power of the bile. For this reason bile is used like soap to clean silk withal; and the painters dilute their stiffest colours with it, to make them spread more equally. When therefore the bile is grown inert, and does not discharge its office in due manner, the glutinous aliments and the pituitous substance, which naturally lines the inside of the stomach and intestines, are increased, become more tenacious, and bring on very severe diseases; which are not to be cured but by making the bile more acrid, or supplying its place with bitter soapy medicines. It often happens, in autumnal fevers especially, that where the bile, grown too acrid or almost putrid, is too largely evacuated either by nature or art, unless those persons after they are cured use bitters to compensate its loss, they shall languish under cold pituitous diseases a considerable time after.

4. The natural gluten, that serves to lubricate and defend the parts, is always accumulated in such persons as live a sedentary inactive life; and their bodies thereby become lax and tumid, and full of glutinous humours. For by due exercise the motion of the humour is increased, and whatever would otherwise be apt to stick in the vessels is carried off. When the limbs are at rest, the mucous liniment of the joints accumulates by degrees, and often causes ankyloses, that are scarce curable. The stomach and intestines have their internal surface lined with a viscid mucus; when the body is strongly exercised, respiration is increased, and by the reciprocal action of the diaphragm and the abdominal muscles, it moves all these viscera, presses them close together, and rubs them against each

each other, 'till by this means they are all deterged. The viscid oily substance, which is collected from animals well fed, and at rest, in such large quantities, is attenuated, and again dispersed, by muscular motion.

5. This is a frequent cause of viscidities in our humours, though seldom thought of. For most of our humours have the property of running into concretion, when a small portion of their more liquid part is carried off. Such viscid mucous concretions may happen even in the very subtle perspiring lymph by inspissation, and so suddenly as would be incredible, if not clear from the most certain observations.

The nostrils of an healthy man, that lives in an air moderately warm, shall not distil so much as a single drop in a day; whatever therefore in this case exhales from the nostrils is very subtle and perspirable. But if in the evening a cold seize him, after having been all day in a warm air, he will straight find an itching in his nostrils followed by a sneezing, and then a very limpid liquor shall begin to fall from them, and this shall be called a cold. In the night, whilst he sleeps, the internal membrane of his nose shall swell, and closing up the passage, he shall not be able to breathe but through his mouth; and the next day he shall frequently blow out of it a large quantity of a thick mucus; this shall continue for many days, and sometimes months: in sleep he feels not the irritation of the mucus in his nose, but in the morning shall find there tenacious lumps like leather formed from the inspissated mucus. The same circumstance shall likewise occur to the wind-pipe, the aspera arteria, and the lungs, so that after sleeping, such thick pieces of concreted mucus shall be thrown up, that one would wonder the patient was not suffocated by them; and hence arise the strugglings, tossings, and troublesome dreams, which such persons, as have catarrhs, labour under, and which seem to indicate a very difficult passage of the blood through the lungs.

How

How much therefore, and frequently, do they err, who would in this case attenuate the blood by sudorifics, diureticks, &c. since, when the most liquid part is carried off, the remainder tends to concretion so much the more.

6. A sound body generates a pituitous matter, which ought to be discharged out of the body when it has done its office; otherwise it will be apt to increase and become morbid. The internal surface of the wind-pipe and bronchial vessels is intirely over-spread with a very smooth mucus, which covers and defends the nerves that are there dispersed, and are so apt to be affected by the least irritation; but in an healthy young person, that breathes well and is active, this mucus is dissipated after it has done its office; or collecting in a larger quantity after sleep, is easily thrown off by a little coughing and hawking. And yet in old men this mucus is gradually collected, and grows sluggish and viscid, and incapable of being thrown off by the weak action of their lungs, and still weaker action of their sides, so that it occasions a kind of *stertor* and hissing noise in the part of the lungs where the air is lodged, 'till at length, with much coughing and trouble, it is brought up. From the constant supply of this mucus arising from the diminution of the concoctive powers of the lungs, the greater dilatation of its vessels, and relaxation of the mucous cells, proceeds that asthmatick cough incident to old men, whereof Hippocrates said long ago (c), "that hoarsenesses and colds in old men did not pass regularly;" *raucedines & gravedines in valde senibus non coquantur*. For which reason whatever is of use to attenuate this viscid mucous matter, and at the same time revive the languid powers, is in this case more particularly serviceable to old men. For such a collection of mucus is not only to be found in the lungs, but in the stomach and intestines, and even

(c) Aphorism. 40. Sect. 2.

S E C T. LXX.

IT arises first in the first instrument of digestion, then in the blood, and after this in the other liquids that are derived from it.

This viscid gluten generated from such kind of aliments will always make its first appearance in the stomach and intestines; and indeed such glutinous matter seems incapable of entering the very small orifices of the lacteal and mesenterick veins: such particles however may steal in, in a separate state as it were, diluted with thinner liquors, and mixing with the blood, by their union there form this præternatural viscosity in the great cavities of the heart and *sinus venosus*; which will generally appear first in the lungs, because the fresh chyle must immediately pass through all its narrow passages. For which reason, when weak people dine upon mealy substances not well fermented, they shall find themselves subject to a difficulty of breathing within a few hours after, from the viscid chyle's passing with a greater difficulty through the lungs.

But the humours secreted from the blood will follow the nature of the blood, from which they are secreted. If the blood therefore abounds with such a viscous disposition, so will the humours also that are secreted from it.

S E C T. LXXI.

IN the *primæ viæ* it causes a loss of appetite; a sense of fulness; nausea, vomiting; indigestion of the aliment; inactivity of the bile, its inviscation and consumption; it breeds phlegm in the stomach and intestines; occasions a costive
and

Sect. 71. a spontaneous GLUTEN. 191
and swelled belly ; and hinders the due preparation, perfection, and secretion, of the chyle.

Loss of appetite.] When the stomach is not able to digest the food, the appetite fails ; and returns with the power to digest. But this viscid matter is seldom accumulated here unless when the stomach is weak. The loss of appetite is known to proceed from this cause, if it falls off slowly and by degrees, and at length be quite gone, without any disease foregoing, or any sign of corruption in the humours that lie about the stomach. Those persons are miserable indeed, who upon drinking spirituous liquors to excess, have at length destroyed the tone of their stomach, and lost their appetite : these, when they rise in the morning, are subject to a troublesome nausea, and continually vomit up a thick phlegm.

Sense of fulness.] It is a constant complaint with persons in this case, that they are always full, are never hungry, and feel a perpetual load lying heavy at their stomach. For the stomach is so made, that when any thing contained in it is hard to be digested, it shall seem as though it were loaded and oppressed. How heavy will a little broth, if made stronger than ordinary, lie upon the stomach of a weak person, who has lately recovered from a disease ?

Nausea, vomiting.] This viscid phlegm sticking to the inside of the mouth, or fluctuating up and down in the stomach, shall irritate it to such a degree as to bring on an almost continual nausea, and often a very grievous vomiting, which if the cause subsists, shall last a considerable time. It is well known, that a slight irritation of the fauces and stomach may produce nausea and vomiting by mere mechanical motion. — What an excessive nausea shall follow from worms crawling in the stomach, or a feather's being thrust down the throat ! This is a disease to which learned men are subject in their more advanced years, who have sometimes the inner coat of the fauces, œsophagus,

œsophagus, and stomach, so disposed, as are the membranes which line the nostrils in a cold; insomuch that a large quantity of mucus shall be discharged from it for several months together.

Indigestion of the aliment.] The food that is swallowed is so wrapped up in the tenacious phlegm, which sometimes sticks here, as to render the effects of the several humours flowing hither altogether fruitless; and yet the action of these, and more especially of the bile, is the principal instrument in forming the chyle. Since therefore those causes, which in a sound man absterge and divide whatever is viscous in these parts, could not hinder the accumulation of it here; much less are they able to attenuate it after it is thus collected. For which reason it is, that the food, especially the harder sort, is often vomited up after it has lain many days in the stomach wrapped up in phlegm.

Inactivity of the bile.] It has been observed in the preceding paragraph, that the glutinous matter adhering in the *primæ viæ*, could not possibly enter the blood, unless diluted; but that the particles, which when united composed that viscous substance, might, when separated and mixed with others that were less viscid, gain an easy admittance into the mouths of the vessels which open into the cavities of the intestines. These vessels are either the lacteal or mesenterick veins. Now whatever enters the mesenterick veins is directly carried by the vena porta to the liver. But as the circulation of the humours in the liver is slower than in any other part, so the glutinous particles will more easily unite in the blood that flows through it, and yet from this blood it is, that both the sorts of bile are secreted; and the bile particularly, which is carried into the gall-bladder, when collected and stagnating there, furnishes the glutinous particles with an easy opportunity of uniting together. The butchers often find the gall-bladder in hogs to be greatly distended

tended, and full of so glutinous a bile, as to admit of being drawn into threads.

Its inviscation and consumption.] It seems very probable, that after the bile has been mixed with the chyle in the intestines, it is absorbed again in part by the mesenterick veins, and so returns to the liver; and after it has gone through the operation of that bowel, is secreted again, so that the most finished part of the bile may go and come the same way several times. But when it is inviscated with this tenacious gluten, it cannot be resorbed by the meseraick veins, but passes with it by the peristaltick motion into the great guts. It is plain therefore, that a considerable quantity of the purest bile may thus be consumed to no purpose.

Phlegm in the stomach and intestines.] *i. e.* of a morbid sort, generated here from the causes already explained. And may not the same causes also give rise to the phlegm, which the antients termed vitreous? It has been often observed, that certain shining lumps have been discharged by stool, that have shook like a jelly, and been transparent as the purest glass; which from their glutinous quality may seem to belong to this place. This sort of vitreous phlegm has generally followed after very sharp pains in the abdomen.

Galen says of himself (*a*), *Memini mihi ipsi accidisse dolorem vehementissimum, ut mihi viderer in intimo ventre terebra perforari, in illo potissimum spatio, per quod a renibus ad vesicam ureteres scimus extendi; injecto deinde oleo rutaceo, quum id pauld post excernere tentarem, excrevi simul cum gravissimo dolore humorem vitreum a Praxagora appellatum, qui vitro fuso, tum colore, tum consistentia, consimilis est, atque id aliis quoque accidere conspexi, &c. frigidissimus autem percipitur sensu tactus, tum ipsorum qui excernunt, tum si quis confestim ipsum tangere voluerit, &c. evacuato hoc humore, dolor sedabatur;* “ I remember I was once seized with the most

VOL. I.

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“ violent

(*a*) De locis affectis, Lib. II. cap. 5. Charter. Tom. VII. pag. 405.

“ violent pain, as if the innermost part of my belly had
 “ been bored through with an auger, in that part chiefly
 “ where the ureters pass from the kidneys to the
 “ bladder: having injected some oil of rue, and soon
 “ after trying to throw it back, together with it I
 “ discharged with the most excessive pain what Prax-
 “ agoras calls the vitreous humour, being both in colour
 “ and consistence like melted glass, which circumstance I have seen in others, &c. this humour
 “ seems very cold both to the persons who discharge
 “ it, and also to the touch, if felt immediately, &c.
 “ after this humour was discharged the pain left me.”
 He owns he was mistaken in thinking that it was occasioned by a stone in the kidney. It does not seem probable, that this severe pain should proceed from an inactive phlegm; this glassy sort therefore seems different from that kind which is naturally collected.

A costive and swelled belly.] The bile seems to be the principal stimulant whereby stools are procured; and therefore we find, when it is too sharp, it causes choleras and violent dysenteries; if it does not pass at all into the intestines, as in jaundices, it produces costiveness. But we have already observed, that the bile grows inactive, and is inviscated and consumed, from an accumulation of glutinous matter in the *primæ viæ*. The intestinal tube is naturally disposed to be very much contracted, but when it is choaked up with phlegm in several places, the contents increase, whilst the thinnest part only passes through, and the thicker remains behind: through its being thus stuffed up, and the elastick air intercepted, the belly often swells to a monstrous size, as may be seen in children labouring under such a collection of pituitous matter, who shall have their little prominent bellies swollen to a surprizing degree, whilst all the rest of the body shall grow less for want of nourishment, till they look like skeletons. These are happily cured by carrying off this foul heap of matter by proper purges, and then giving medicines which strengthen,
 at

at the same time rubbing the belly well with aromatick ointments.

It hinders the preparation of good chyle, &c.] In order to convert the food into good chyle, we stand in need of the action of the stomach and intestines, together with an effusion of both sorts of bile, of the pancreatick juice, the *succus gastricus*, and the liquor that is separated in the glands of the intestines, &c. but these are all impeded by an adhesion of glutinous matter to these viscera; for which reason the chyle in this case cannot be brought to its due perfection. Besides, this glutinous matter will also stop up the very small mouths of the lacteal and mesenterick veins, and so prevent the secretion of the chyle after it is formed in the intestines, by which means the body, for want of nourishment, will be consumed by a true marasmus.

S E C T. LXXII.

IN the blood it causes visciditity and paleness, and renders it incapable of passing into the vessels, through which it ought to circulate; in the vessels it occasions obstructions, concretions; it produces a pale urine, with scarce any smell; viscid spittle; a white swelling; retarded secretions; the deficiency of the more subtle liquids; and so a coalition of the smallest canals.

If such pituitous matter, arising either from the glutinosity of the food we take down, or from the natural mucus not being sufficiently deterged, shall infect the blood, certain symptoms of ill health will follow, which when observed are termed the effect of a spontaneous gluten inhering in the blood.

Visciditity.] This is very distinct from the inflammatory viscid, as was observed §. 69. which does not dissolve in water as this viscid mucous matter does.

This has often been seen when a vein has been imprudently opened in persons of this cold pituitous constitution; in which case a very little red concremented blood is found swimming in a large quantity of viscid glutinous serum.

Paleness.] We may see the colour of the blood shining through the tender vessels in all those places where there is no skin; as in the tongue, the gums, the inside of the mouth, the nose, the corners of the eyes, the adnata, the inside of the eye-lids, &c. when therefore all is pale in these places, we know that the viscosity in the blood is not of the inflammatory but the viscid pituitous sort. When the blood is inflamed, and fizy, there is a heat and redness in every one of these parts; but a paleness and coldness, in case the phlegm predominates. For the chyle is always white when it enters the blood; and by virtue of the circulation changes into red blood; but weak bodies, which are not able to work this change, are always pale. This is plain from the chlorosis or green-sickness, to which girls are so much subject about the time of the first eruption of the menses; for having attained their utmost growth, the solids and fluids being to be ballanced; mean time the chylopoietick viscera act as before; whereby more good liquid is generated, that is, the mass to be moved is increased, while the moving power remains the same. Hence the whole body becomes sluggish, tumid, pale, not through a loss of good blood, but because more chyle is poured into it, than the powers can change into red blood. This disease always is attended with a glutinous viscosity, as appears by the doughy softness, the paleness, and sluggishness, of the whole body.

Renders it incapable, &c.] For at length the viscid blood will not pass through the vessels; especially as the circulation is always more languid in such persons, as are of too phlegmatick a constitution. This incapacity of passing through the vessels will shew itself principally in the smallest vessels, in the lungs and
I brain;

brain; the action of these parts therefore will be the most disordered, and consequently such persons as are thus indisposed frequently die lethargick at last, or are choaked by an oppression of the lungs.

Obstructions in the vessels.] Which are much more frequently caused indeed by an inflammatory visciditity, and yet proceed from a cold pituita. As certain portions of the fluid in this case cohere in too viscous a manner, nor can the action of the vessels divide them so minutely as is required for their passing through the very small passages of the capillary vessels.

Concretions.] Wherever the pituita stagnates, it will coagulate into dense masses resembling leather; especially if the more liquid parts fly off, as we see in the mucus of the nose. Such concretions are oftentimes thrown up from the fauces, and sometimes from the lungs, as we daily see.

Pale urine with scarce any smell.] This circumstance always shews the powers of the body to be languid; the urine therefore is constantly pale in children, lax women, and feeble old men. The stronger a man is, so much the more colour and smell *cæteris paribus* will his urine have. And indeed this spontaneous gluten is seldom bred in persons that are strong; for as in these the bile is sharper, and the action of the viscera more powerful, so whatever is viscous in them is by this means attenuated; and consequently this disease is usually incident to weak people.

Viscid spittle.] The spittle has some degree of visciditity even in the soundest; and chiefly because the mucus of the mouth and neighbouring parts is mixed with it. But as the liquids follow the nature of the blood from whence they are secreted, it is no wonder that a saliva more than ordinarily viscid should be secreted from too viscid blood; this spittle mixed with the food in chewing, and swallowed down into the stomach, augments the visciditity in the first office of digestion.

White swelling.] The antients called the *pituita λεύκαν φλέγμα*, and for this reason gave this disease the

name of λευκοφλεγματία. In this case the blood is degenerated into so bad a state, as to lose both its redness and consistence, to grow lighter, become more lax, and acquire almost a cold mucous nature. It is called also sometimes by the same name, when the blood becomes thin as water, and distends the parts under the skin with an hydropical tumour; but the Antients called it then more properly a dropsy ἀνασάρκα. These two diseases are evidently distinct, though often confounded; for in a *leucophlegmatia* the humours are of a cold pituitous nature, in a dropsy quite watery and thin. An *anasarca* generally begins in the lower parts, and as it increases the tumour ascends; in a *leucophlegmatia* the pituita is more equally diffused over the whole habit: whence that laxity and doughy softness of the whole body, attended with a pellucidness not unlike to silk-worms. Hence Hippocrates distinguishing them says (a), *quum pituita alba corpus ditinuerit, totum corpus tumore albo intumescit, &c. si curatus fuerit inchoante morbo, convalescit; sin minus, in hydropem transit morbus, & hominem perimit;* “when white pituita has seized upon the body, the whole body swells with a white tumour, &c. if it is carried off in the beginning, the man recovers; otherwise it will turn to a dropsy and kill him:” and elsewhere (b), *albæ pituitæ hydrops supervenit;* “a dropsy follows the white pituita.”

The secretions interrupted.] All secretions are made from the blood. In order therefore that these be performed in due manner, it is necessary that the blood should be good. But though weak bodies can convert the aliment into chyle and milk, they cannot turn it into solid red blood without great difficulty; for which reason it is they have so white an aspect. If their powers increase, the humours are more changed, though the change is not compleatly wrought; in this state they look yellow or greenish, as we see in
a chlo-

(a) De affectionibus, cap. 5. Charter. Tom. VII. pag. 625,

(b) Aphor. 74. Sect. 7.

a chlorosis. For the same reason they scarcely perspire at all, make little urine, secrete but little bile, &c. as the accumulated pituita either stops up the smaller secreting vessels, or by distending the parts compresses them, and so interrupts the secretion.

The deficiency of the most subtle fluids.] It is plain to be seen in leucophlegmatick people, that all the functions are languid or quite fail, that depend on the motion of the finest and most subtle liquid, which passes through the smallest vessels. Hence that slowness to all muscular motion, that torpor, dulness of the senses, forgetfulness, and sleepiness, observable in this case. For by the wise appointment of nature, the blood that goes to the brain seems to be cleared of its more viscid and less moveable part, by being first conveyed in the external carotid to the nostrils, the tongue, the inside of the mouth, &c. and there depositing so large a quantity of viscid mucus, by which means the purest and most solid blood is carried to the cerebrum and cerebellum for the secretion of the animal spirits. When therefore the blood degenerates into a pituitous inactive state, the due secretion of the spirits fails, and consequently all the actions that depend upon it.

The coalition of the smallest canals.] We are certain, that even the large vessels may collapse and grow together, if deprived of their circulating fluid. The arterial blood, which lies between the pulmonary artery and the aorta, and is so large in a foetus, grows together after the birth; when the unfolding of the lungs gives a free passage to the blood through the pulmonary artery; by which means it flows this way no more, and the sides of the canal collapse, and unite very soon. Now if this be the case in so large a vessel, how much more will it happen in vessels that are small beyond all imagination, when deprived of the very subtle liquid that passed through them? In this disease it is plain from what we have already said, that most subtle part is wanting which should keep them open; and from this cause it is, that af-

ter an apoplexy or palsy arising from this glutinous cachochymy, incurable evils are so often left remaining.

S E C T. LXXIII.

HENCE all the concoctions, circulations, secretions, excretions, all the vital, natural, and animal, motions are disordered, whence arise suffocation and death.

The several particles here mentioned do all depend upon the due motion of the liquids through vessels of a due strength. When therefore the too great glutinosity of the blood hinders it from passing freely through the smaller vessels, or indeed from passing at all, these mischiefs will necessarily follow. This will clearly appear by considering the symptoms discernible in a chlorosis.

For in this disease there is either no concoction of the aliments, or at least a very depraved one, and the tendency to spontaneous corruption is universal. Hence proceed sour and fetid belchings, &c. this circulation of the humours is quite disordered, as appears by the pulse, which is generally irregular in this disease, and the cold the consequence of a diminished circulation. The secretions in general almost all vary from the natural rule, as appears from the viscid spittle, the inactive bile, and the want of spirits. The excretions are entirely changed; the urine pale, frothy, with scarce any smell; the belly generally costive; scarce any perspiration. The vital motions are entirely disordered; as appears by the difficulty of breathing, and the panting at every the least motion, the enormous palpitations of the heart oftentimes, the swoonings, upon every the slightest occasion; the slow low pulse whilst sitting still; and the quick and unequal one in case of motion; the natural functions are entirely depraved; the appetite either quite gone, or a
præter-

præternatural longing for every extravagant thing, such as sand, lime, chalk, &c. which girls in this disease so often swallow down in private, from whence frequently arise most miserable diseases. Oppressed by eating, and yet the body not repaired. The animal functions also are entirely languid; they can scarce drag along their feeble limbs, and are presently tired with every the least motion; add to these a dulness of all the senses, stupidity, and a most troublesome giddiness. At length the blood not being able to pass through the lungs by reason of its viscosity, they are either suffocated, or die of a lethargy for want of spirits.

S E C T. LXXIV.

FROM hence (69, 70, 71, 72, 73) the diagnosis, prognosis and anamnesis, of this disease appear, nor is it difficult to see what the cure indicates.

The diagnosis.] Which shews when the disease described is present, is easily to be learned from what has already been said. If there be a weakness of the solids, a want of good blood, if the diet has been of that kind in which this gluten prevails, if the manner of life be sedentary, and the appetite begins to fail, without a fever, or thirst, or any mark of putrefaction, if the pulse be weak, and all these symptoms be attended with a sense of coldness, we may then certainly conclude, that a cold pituita predominates.

The prognosis.] All those bad circumstances should be here reckoned up as prognosticks, that were enumerated §. 71, 72, 73. From the same principles also is to be had the anamnesis of this disease when past,

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The cure.] This also is to be deduced from the same observations, to wit, by avoiding the causes mentioned in §. 69. for by this means the production of a viscidty may be prevented; or if it is already produced, it must be attenuated by proper remedies, that it may not henceforward do any farther mischief.

S E C T. LXXV.

WHICH will be obtained, 1. by the use of meat and drink well fermented, seasoned with salt and aromack ingredients; 2. by broths made from the flesh of birds; 3. by strengthening the vessels and viscera; 4. by an increase of motion; 5. by medicines that dilute, resolve, stimulate, and are of the bilious and soapy kinds; 6. by friction, heat, baths, blisters. But besides this the inner parts of the body are liable to glutinous or thick concretions of fundry other kinds, such as caseous, mucous, mucilaginous, friable, ceraceous, pultaceous, dreggy, calculous, tartareous, inflammatory serous, polypous, meliceratous, steatomatous, dense atheromatous, schirrous concretions. And a Physician ought to be extremely careful that he do not expel together with the morbid gluten that benign, natural, lubricating, unctuous, defensive, glutinous matter, which nature has for necessary uses placed in the eyes, eye-lids, nose, mouth, fauces, gullet, stomach, intestines, pelvis, ureters, bladder, urethra, in the mucilaginous sheaths of the tendons, in the articulations of the joints, in the larynx, aspera arteria, and bronchia, which has too often happened by the fatal mistake of ignorant men and quacks.

1. Flower mixed with water becomes a viscid ductile paste; ferment this paste, and whatever is tenacious in it is divided, and so much the more as the fermentation is longer and greater. Bread well fermented therefore is proper here, especially biscuit; for this melts of itself if you eat it; especially seasoned with a very little salt and the agreeable spices mentioned in the *materia medica*.

For drink, wine, or strong beer, which is possibly preferable to wine in this case. Where the gluten is inflammatory, we give a very smooth decoction of barley, which would increase the viscosity we are now treating of. Of the same barley differently managed is made beer, a noble remedy in a cold glutinous degenerated state of the blood, and of the humours secreted from it. For this purpose the barley is steeped in water till it swells and begins to sprout, it is then spread on a floor and turned twice a day till most part of its moisture is gone; it is next dried on a kiln and called malt, which after being ground is infused for some hours in water, that is poured upon it boiling hot. This water enriched with very near the whole substance of the barley dissolved, is boiled in another vessel, and then being fermented produces beer; which retains its spirits in stronger bonds as it were than wine, and for this reason its effects in the body are most lasting. This beer, of the stronger sort especially, is a most noble remedy: and Brunswick mum with biscuit has often cured diseases of this kind without the application of any other remedies.

2. For these broths have not so much of the tenacious gelatinous part, but as soon as they are swallowed, are by the heat of the body in a manner disposed to putrefy, especially if made of the flesh of little birds that live on insects, by which means their flesh is more inclined to putrefaction than that of animals which have been fed with grass; and besides they are seasoned with spicy ingredients: for putrefaction,
through

though but beginning, attenuates whatever is viscid; thus the thickest jelly of hartshorn, from the moment it begins to putrefy, shall become as liquid as water.

3. We have already given directions how the vessels and viscera are to be strengthened §. 47. and we daily see robust country people digesting the hardest fare, such as potatoes, unfermented mealy food, flesh hardened with smoke and salt, without difficulty, which would produce the most obstinate obstructions in the viscera of weak persons.

4. It is a vain attempt to cure a person labouring under this pituitous indisposition by food and physick, unless you can prevail upon him to cast off that sluggishness which is natural to this disease, and to exercise himself almost beyond his strength. And yet the motion must not be too violent at first, lest this mucous matter should be thereby thrown upon the lungs, which could not be without very great danger: this often happens, when the glutinous matter collected in the winter is suddenly liquified by the heat of the spring, and mixing with the blood, is stopped in its passage through the very minute vessels of the lungs, by which means the patient is suffocated at once; but the motion must be gentle in the beginning, and increased by degrees; and if the body is too weak to use exercise, friction should supply its place.

5. By diluting medicines.] Water is the only proper diluent, and whatever other medicines are called diluents, act only on account of the water they contain. That cold pituitous matter we here treat of may be diluted and dissolved in water, especially if warm; but this is a momentary relief only, for by weakening the solids it would increase the cause of the disease. This is that deceitful relief, that men given up to study, and labouring under a load of phlegm, feel by drinking warm watery potions; though in the end it frequently proves their destruction. Such diluents therefore are only good in cases
where

where it is required speedily to dilute the pituita, that is, whilst it is still fluctuating in the stomach.

By resolvents.] These have been treated of §. 54. numb. 4. where also we spoke of diluents.

Stimulants.] Every thing that, when applied to the body, increases the motion of it, may be called a stimulant, this being the common effect of all stimulating medicines however they act. Some of them appear to act by the figure and rigidity of their particles, which having sharp points, and being driven by the course of circulation against the sides of the vessels, cause them to contract the quicker by means of this irritation. But for the greatest part of them, though we clearly see their effects, yet we do not so easily discern in what manner they act upon our bodies. Cinnamon, for instance, excites the languid powers by a most agreeable and efficacious stimulus; and yet that which gives the cinnamon this virtue is incredibly minute, and when freed from the oily part, wherein it is wrapt up, escapes the notice of our senses. Whatever this virtue is, it all enters into the oil, that is obtained from cinnamon by distillation, and yet if this oil be exposed to the open air for some few days it will lose all its virtue without any sensible loss of weight. Now who shall point out the figure of this most subtle part, wherein the stimulating virtue of the cinnamon resides? So in poisons, what terrible disorders do their stimulating particles create in the whole corporal system? What violent commotions do they raise? In the small-pox, measles, plague, &c. with what prodigious power does the poison act? And yet here also the minuteness of the stimulating particles eludes our enquiry; their power is known only by their effects.

But the affections of the mind also, which are only a change of the thoughts, work surprizing alterations in the body, and are capable of raising violent fevers, of increasing, diminishing, and disordering, both all the secretions and excretions.

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The effect therefore of stimulants does not always depend upon the figure, weight, and stiffness, of their particles. And it suffices for the Physician's purpose, that he knows what particulars applied to the body shall increase its motion, though he does not know the manner whereby they act.

These however all seem to act by exciting greater motion and heat, and so in their last effect dividing the glutinous matter, and changing it in such manner by this means, as to make it obtain the nature of the sound humours.

For that the blood, when oppressed with a pituitous load, may by the action of the vessels on the liquids they contain, thus acquire every property required to sanity, is clear from the most certain observations.

A weakly girl labours under a chlorosis, her whole body is puffed up with a lax oedematous swelling, every part about her is pale and cold. Let her first take a gentle vomit or purge of Pill. Ruffi. or some such like medicine, to carry down the mucous load that is lodged in the *primæ viæ*, that it may not prevent the efficacy of other medicines; and then give a medicated wine made of aromattick ingredients and filings of steel; and you will find that by the use of these a greater heat and a kind of slight fever will as it were kindle in her body; the lax humour in all the parts will begin to subside, and the agreeable red shew itself in the lips, gums, and skin; and without any evacuation of the predominating viscid, the solid red blood will return again, and the functions be restored to their perfect soundness.

It was certainly very prudent advice in Galen, when he said (a), *pituita autem frigida & humida est, & veluti quoddam semicoctum alimentum; quare non est evacuanda, sed debet in corpore manere atque alterari* (ἀλλοιῶσαι) “ that the pituita is cold and moist, a sort
“ of

(a) In librum Hippocr. de alimento Comment. III. Charter. Tom. VI. pag. 255.

“ of half concocted aliment; and therefore it is not
 “ to be evacuated, but retained in the body and al-
 “ tered.”

In the *materia medica* you have these stimulants enumerated according to their various classes.

By bilious medicines.] The bile and phlegm are of so opposite a nature, that they can never predominate together; bile being the greatest detergent, dissolvent, and attenuant, of all pituitous matter. If the bile be hindered from flowing into the duodenum, and by this means be thrown back into the blood, it dissolves it to such a degree, that after a long jaundice there usually follows a dropfy. Wherever this viscid pituitous matter is accumulated, the bile is either deficient in quantity, or it is too inactive. Nothing therefore seems more proper in this case than to supply the defect of the bile, either by giving the bile of some other animal, or by the use of bitter plants, such as wormwood, centaury, &c. The former seems the most natural method, and for this reason the bile of the most voracious animals that use no manducation, nor have several of the other aids of digestion, has been chosen principally for this purpose; as in these a sharper bile than ordinary seems to have supplied the want of the other. Thus the gall of a jack that devours fishes whole, and of eels, has been much commended for this purpose. Zoographers observe, that the fiercest animals have the most acrid bile, and for this reason the Apothecaries keep in their shops the gall of bulls inspissated. And perhaps that most costly porcupine-stone, called *Pedro del Porco*, may owe its virtue as well as its origin to bile.

Soapy.] The Venetian soap has been chiefly commended as the most mild dissolvent of all glutinous fat substances. To this Physicians add about one twentieth part of gall, and give it in pills; and thus endeavour to supply the defect of the natural bile. For the hepatick bile is never bitter, but perfectly saponaceous, and sufficiently resembles the Venetian soap.

soap. The cystick bile flows out in very small quantity by reason of the narrowness, intorsion, and situation, of the neck of the bladder. Thus art endeavours to imitate nature.

6. By friction.] What the effects of friction are has already been shewn §. 28, numb. 2. Children, whose bellies swell through these glutinous obstructions, are greatly relieved by having them rubbed with rough cloths: this should be done in a morning after sleep, and fasting; for when the stomach is full they cannot easily bear it. Nay Galen would not admit that any friction at all should be used to the belly (a); *quam aliqui periculum sit, ne & cibum deterius concoquat, & succus quispian ex eo semicrudus in corpus digeratur, & caput turbetur, & stomachus subvertatur*; “fearing lest by this means the food should be
“ worse concocted, or some half-crude juices be
“ thereby thrown into the body, the head disordered,
“ and the stomach subverted.” But if the friction be used whilst the stomach is empty, there is no danger of any of these consequences.

Heat.] All the medicines which are judged serviceable in the cure of glutinous diseases, are generally such as occasion a greater heat in the body. But heat excited by muscular motion will be more especially beneficial here, because it strengthens too. Nor will the loss of humidity in this case be of any prejudice, since in these diseases there is generally too large a quantity of moisture.

Baths.] These are either wet or dry. The former act by relaxing and diluting. To these therefore are added aromatick herbs, which strengthen and attenuate, and at the same time frictions are used: afterward the dry baths are of service by exciting a greater heat. But as the whole external surface of the body is covered over with bibulous veins, the virtue of these aromatick herbs

(a) De sanitate tuenda, Lib. III. cap. ult. in fine. Charter. Tom. VI. pag. 114.

herbs may be transmitted through them, especially when they are relaxed in the bath.

Vesicatories.] So are those remedies called, which when applied to the skin, lift up the epidermis into a bladder full of a thin ichor. They are made of the most acrid plants, such as horse-raddish, mustard, the ranunculi, &c. or most commonly cantharides. These act by raising an heat in the part to which they are applied, and thence diffusing it over the whole body. When they are imprudently applied, and especially the cantharides, they cause a fever, thirst, a burning heat, a cadaverous smell, and a most troublesome strangury; wherefore Dioscorides reckons them among the poisons. These all act as stimulants, whereby they excite the languid motion of the blood, and by their dissolving power, whereby they divide and attenuate the pituitous matter, for which reason it is, that they prove so serviceable in all languid and cold diseases. But where the humours are dissolved, acrid, inclined to putrefy, and are thrown into any violent motion at the same time, there the use of them does not not seem to be altogether so safe.

But besides this, the inner parts of the body are liable to, &c.] We learn from medical observations, that strange concretions of the humours may happen in various parts of the body, and of a quite different nature from each other, which shall interrupt the action of the parts where they are seated, and to be the cause of very wonderful and obscure diseases. The principal classes of these concretions are here enumerated.

Glutinous or thick, &c.] We have shewn through the whole of this chapter, that such substances may be produced in the body, partly from the resembling nature of the aliment, and partly from the accumulation of the natural gluten.

Caséous.] Cheese is the produce of milk only, for the chyle has it not; by adding the coagulum the milk separates into two parts, *i. e.* a thin whey and a

thick curd, which when the whey is all expressed forms cheese; this when dried will often become hard as horn, and even like the horns of animals will grow ductile by being exposed to the fire, and in distillation yields a volatile alkaline salt. And yet the milk containing this cheese, which is capable of assuming so great a degree of hardness, was carried with the blood through all the narrow passages of the lungs; if therefore by any accident, such a separation of the milk into whey and curd should happen as it moves in the vessels, what numberless disorders might arise from it? If the milk stagnates and corrupts in the lactiferous ducts of the breasts, the thin whey drops off by the nipple, whilst the curd which is left behind occasions inflammations, suppurations, schirrhous's, and frequently cancers. There was found a tumour in the abdomen of a young gentleman, containing seven pounds and a half of white matter, which was partly fluid like milk and in part caseous (c).

Mucous.] In all the places that are covered by the Schneiderian membrane, which is the proper seat where the mucus is formed, we learn from daily observation, that mucus may be produced, accumulated, and often grow into such masses as are not easily afterwards to be dissolved. But it seems still more surprising, that a mucus should be formed in such places, as by their natural structure are set apart only for the secretion of the most subtle humour: for such a mucus has been found in the very ventricles of the brain, and been the occasion of a cold apoplexy (d).

Mucilaginous.] The Haverian glands, so called from Havers, who first described them, are plainly to be seen in the joints, and more especially in the larger ones, which secrete a mucilaginous slime that serves to lubricate the receiving and received bones, and the inner surface of the ligament that surrounds the

(c) Acad. des Sciences, l'an. 1729. Hist. pag. 17, 19.

(d) Theoph. Boneti Sepulchr. Lib. I. pag. 103, 104, 105, 108, 131, &c.

the articulation. This mucilage either growing too thick, or becoming accumulated through want of moving the joint, will often occasion strange tumours about the joint, and sometimes bring on an incurable anchylosis.

Friable.] The eyes of an healthy person, being overspread with a most subtle lymph, do naturally shine; but if the least disorder happens here, this liquid will be plentifully secreted and fall down in a larger quantity, and then there shall appear a thick viscous mucus closely adhering to the adjoining parts, and deforming the beauty of the eye. This glutinous matter shall become still thicker, and form little masses called *lemæ*, which in a few hours time shall be collected in the greater angle of the eye, and be absolutely friable. And thus shall a hard friable substance be produced within a few hours from a most limpid humour secreted from the purest blood.

Ceraceous.] We learn from a strange case, which has once happened, that the humours of the eye, which in health are so limpid and pure, are capable of being converted into a substance resembling tallow. For upon the extirpation and dissection of an eye, that had hung out a considerable way beyond the eyelids, and was extirpated to avoid worse consequences, all the humours in it were found to be thus changed (e). And if such an alteration could be wrought in the eye, what may not possibly happen in the other parts of the body? Such a ceraceous matter naturally resides, pent up in its proper cysts, in the wrinkles of the anus, which when inspissated and accumulated may give rise to tumours of this nature (f).

Pappy.] Severinus found such a kind of matter in several abscesses (g). And it seems highly probable, that something of a resembling nature may have been observed in the internal parts.

(e) Theoph. Boneti Sepulch. Lib. I. pag. 427, 428.

(f) H. Boërhaave Epist. Anatom. ad Fred. Ruyfch. pag. 11.

(g) De Recondita Abscess. Natura. pag. 183.

Dreggy.] The liver, when inflamed, like all other parts of the body, will sometimes suppurate, and this friable bowel, when quite consumed, will not turn to good pus, but instead thereof a corrupted matter, not unlike dregs, shall pass off by stool; or in case the abscess points outwardly, upon the rupture or cutting of the integuments, a like matter shall be discharged; whence Hippocrates observes (*h*), that in case of a dreggy discharge from a suppuration in the liver, the disease is mortal.

A tumour has been found in the abdomen under the peritonæum full of stinking matter, like the lees of red wine both in colour and consistence, amounting in quantity to about twelve pints (*i*).

Severinus found a resembling substance upon opening a tumour in the left knee (*k*).

Calculous.] That stony substances are generated in the body is unquestionable, especially in the urinary passages, the kidneys, ureters, bladder, and about the liver; in which places the humours stagnate, as it were, in larger cavities, or move very slowly, at least in the liver: so that calculous concretions may the more easily be conceived to happen in them. But it is more wonderful, that a stone should be found in the substance of the heart, which is never at rest (*l*); as also in the cavity of the belly fixed to no particular part (*m*); as also, that the brain of a very strong ox, which four times escaped out of the hands of the butchers before he could be killed, should be found all over stony (*n*).

Tartareous.] So are those calculous concretions called, which cover the whole surface of any particular part with a stony crust-like tartar. The placenta is sometimes covered with such a crust, and the dura mater

(*h*) Coacar. No. 451. & Aphor. 45. Sect. 7. (*i*) Peyer. Parerg. Anatom. pag. 191. (*k*) De Recond. Abscessuum Natur. pag. 155.
 (*l*) Philosoph. Transact. abridged, Vol. III. pag. 158.
 (*m*) Acad. des Sciences, l'an. 1703. Hist. pag. 46.
 (*n*) Id. l'an. 1703. Mem. pag. 315.

mater of the brain has been found to be incrustated with a like stony matter (o).

Serous inflammatory.] This appears in pleuritick blood, which has the globular part of it covered with a thick skin like leather, that can scarce be cut through with a penknife, formed from the condensation of the serum: for the blood is naturally prone to concretion, and this disposition is considerably increased in all inflammatory diseases.

Polypous.] Of this sort, §. 52. numb. 2.

Meliceratous, steatomatous, atheromatous.] These differ only as to the various consistence of the matter they contain. Galen in his treatise of præternatural tumours, cap. 5. says, that an atheroma contains a substance resembling soap; the mileceris a substance like honey; and the steatoma a substance like suet. These are generally contained within a kind of a membranous coat (p). In the external skin, if the duct be obstructed, the scales will rise by the addition of new matter, that is not carried off, and produce a tumour of this sort. We learn also from the observations made by Physicians, that the same circumstance may happen to the internal parts. A steatoma formed between the cerebrum and cerebellum to the size of a man's fist, has first caused blindness, and afterwards ended in death (q). A true steatoma weighing more than six pounds has been found in the cavity of the breast, which has at last after exquisite misery killed the patient (r).

Schirrhus concretions.] A perfect schirrhus is defined by Galen (s) to be a præternatural tumour without sense and hard. Such a tumour is often left after inflammations ill cured, especially in the glandular parts. Innumerable observations might be quoted from the

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practical

(o) Theoph. Boneti Sepulchr. Lib. I. pag. 59. (p) Dictionar. Medic. ex Hippocrat. Aretæo, &c. pag. 465. (q) Theoph. Bonet, Sepulchr. pag. 422. (r) H. Boërhaave atrocis & rarissimi morbi Historia altera. (s) Method. Med. ad Glaucon. Lib. II. cap. 6. Charter. Tom. X. pag. 378.

practical writers to shew, that all the viscera have at some times become schirrhous.

A Physician ought to be extremely careful that he do not expel that benign natural gluten, &c.] This advice is of the greatest consequence, as the neglect of it has given occasion to scandalous mistakes. For many have been of opinion, because life and health seemed only to consist in the free course of the fluids through the vessels, that the liquids could never be too thin, and that whatever was thick or tenacious was to be reckoned morbid. They, who have thoroughly examined the fabrick and use of the parts, have discovered very plainly, that a viscid mucus is secreted in many parts of the body by proper organs for certain necessary uses. If the edge of the eye-lids, which are so often rubbed against each other, were not defended with such a soft wax, they would soon be inflamed and excoriated; as appears by those most troublesome forenesies, which so frequently happen from the want of it. If the nerves, that are dispersed through the large cavities of the nostrils, were not covered over with mucus, they would soon grow dry by being exposed to the air, and the sense of smelling be lost. All the parts within the inside of the mouth, the fauces, œsophagus, are covered with a like liniment, that what is to be swallowed may pass the more easily over parts already lubricated. The internal surface of the stomach and intestines, even in the soundest animals that are slain, appears to be very much lubricated, and overspread with a resembling mucus, that the extremities of the vessels and nerves, which here lie open and prominent, may be defended from the acrimony or asperity of the aliment; so that when it is rubbed off in a dysentery, the want of it causes most excessive pains, which are only to be asswaged with such remedies as are capable of supplying its defect by their gluten. All the passages through which the acrid urine passes are lined with such a mucus; which if it be wanting in a certain part of the urethra,

thra, will occasion a most troublesome strangury to ensue, that may notwithstanding be happily cured by the use of the mucilaginous decoction of marsh-mallows. The tendons are surrounded with mucilaginous sheaths, that they may move in a more easy manner, and in case these sheaths are destroyed by means of a suppuration or gangrene, they are no longer capable of being moved at all.

The extremities of the bones in the joints are spread over with a thin mucilaginous matter; and in case this fails by any accident, through violent or long continued motion, through diseases or old age, a snapping and pain in the joints will always follow. The internal surface of the larynx, the aspera arteria, and the whole airy cavity of the lungs, has nerves so irritable, that if they were not covered with a mucus, the contact of the air would occasion a perpetual coughing.

Since then there is a mucus naturally belonging to all these several parts, it is not rightly judged to be morbid, and for this reason when thrown out of the body is followed by very ill effects. The internal use of cantharides has often been attended with the discharge of a bloody mucus expressed in a small quantity, but followed by a cruel strangury, the urinary passages being as it were scraped bare by the virulent acrimony of these insects. Sharp purges after a great many stools shall frequently bring away a small quantity of yellowish gluten streaked with blood, and be followed with a violent tenesmus and pain; this is no more than an abrasion of that benign gluten, which lines the intestines, and is succeeded by most exquisite pains arising from their being excoriated. And thus of every other part.

The DISEASES from a spontaneous alkaline CAUSE.

S E C T. LXXVI.

THERE are some plants abounding with a sort of matter, which when it corrupts of itself does not become acid or viscid, but is resolved into a fetid, volatile, fat, alcali: such are almost all the aromatick plants that are very sharp to the taste. But these are seldom taken in such a quantity, as to cause a disease of themselves. But if this should happen, it ought to be assigned to an acid oleose alcali.

Alcali is a name now received in the art, and seems to be derived from a very salt herb called *Kali*, which when set on fire will leave behind it ashes, that are plentifully stored with an acrid salt. Many plants burnt in an open fire will produce ashes that are more or less salt; these ashes boiled in water will yield a saline lixivium, which upon evaporation shall leave behind the salt called alkaline. This is to be distinguished by certain marks (a): it remains fixed in the fire a considerable time, but becomes liquid entirely if exposed to a moist air; it has a sharp, fiery, urinous, taste, but no smell; when mixed with acids it raises an effervescence, and turns the blue syrup of violets green, &c.

This salt drawn from vegetables by a strong fire in the open air can never be produced naturally in the body; but may be thrown into it from without.

When vegetables are burnt in an open fire, a smoke rises, which striking to the sides of the chimney, appears,

(a) H. Boerhaave Chem. Tom. I. pag 765.

Sect. 76. a spontaneous alkaline CAUSE. 217

appears in the form of a black shining matter called foot. This when distilled will yield a considerable quantity of salt adhering to the sides of the receiver; this salt affects the tongue with an urinous taste, like a fixed alkaline salt, raises an effervescence with acids in the same manner, and changes the colour of the syrup of violets; for these qualities it is justly called an alkaline salt, and easily moveable by the least action of the fire.

The parts of animals, tried in the fire, have, when distilled, yielded a like volatile alkaline salt.

Putrefaction, so far as we have hitherto been able to discover, most certainly reduces the bodies of animals and vegetables to such a state, that their saline principle shall become a volatile alkali (b).

This volatile alkaline salt is to be found prepared by the natural structure of the plant, requiring no art to make itself seen. Mustard-seed, which if you bruise it, presently exhales this volatile alkaline smell; if pounded with vinegar, shews the signs of effervescence; and yields immediately in the first distillation a volatile alkaline salt.

There are other plants, in which the marks of a present alkali are less clear, which yet when left to themselves corrupt into a volatile fetid fat alkali; of these you have a catalogue in the *materia medica*.

The origin of an alkali in the body is either from our humours growing putrid of themselves; or from the aliments being of a disposition inclined to putrefy; or lastly, from alkaline salts taken in.

But alkaline salts are seldom taken in so large a quantity as to be capable of doing much mischief.

Nor are the acrid aromatick herbs mentioned in this paragraph apt to be swallowed in such quantities, as to be capable of being the cause of producing a spontaneous alkali in the body. And yet it has sometimes happened, that the blood has been so dissolved
by

(b) H. Boërhaave Chem. Tom. I. pag. 803.

by the imprudent use of them in the scurvy, (for they are almost all of them called antiscorbuticks) and the vessels so eroded, that the fatal hæmorrhages that have ensued, together with the stinking breath, the fetid urine, and cadaverous stools observable in this case, have given sufficient reason to believe that putrefaction has been caused thereby.

S E C T. LXXVII.

OUR liquids formed from our feeding on the parts of animals are various; 1. According to the different sorts of food which the animal lives on; 2. According to the different parts of them which we eat ourselves.

That the part which, according to the established rules of health, is continually flying off from the substance of both solids and fluids, may by the conspiring action of all the viscera be supplied from the food, it is requisite that this food should lay aside its own natural disposition, and be converted into the nature of our humours; so that when it has been wrought up to the last degree of perfection, all the humours shall be of a resembling nature, how different soever they may have been before. But this transmutation is not to be wrought but by the repeated action of the viscera and vessels continued for many hours together; for the aliment very often retains its own nature a considerable time; and then the liquids derived from it are different according to the different nature of the aliment we take down. But those liquids, which are formed from animal food, more especially differ from each other upon a twofold account.

For, 1st. All animals may in this respect be divided into three classes; for either they live on vegetables only, as horses, oxen, sheep, &c. or on animal substances

Sect. 78. a spontaneous alkaline CAUSE. 219
stances only, as the lapwing, the swallow, &c. or on
both, as sparrows, &c.

2. If cows milk be set in the open air in a hot day, it will turn sour; the flesh of the same animal will putrefy. The person that eats the milk therefore takes down an aliment that will turn acid of itself; and he that eats the flesh, takes down a substance disposed to putrefaction; or if the marrow be eaten, this, in a weak stomach, will more especially incline to turn rancid. It is plain, therefore, that the different parts of the same animal are liable to very different spontaneous changes.

S E C T. LXXVIII.

FOR the animals that feed on herbs and water will have either an acid chyle, or a chyle that will easily turn acid, and consequently will give a milk of the same nature. This in our bodies, following its own tendency, will act in much the same manner as a vegetable diet: see 61 to 76; and create a viscid matter in the first passages resembling cheese, which is here a peculiar sort of viscosity.

The chyle, which is formed of the food we take down, and even the milk itself, do as yet more partake of the nature of the food that is swallowed, than of the person who swallows it; so that whilst the cow feeds in the meadow on grass and water only, the chyle and milk shall both retain the nature of the grass, and both incline to acidity.

A viscid matter resembling cheese.] The blood and its serum are strongly disposed to form concretions; and this circumstance seems peculiar to the human liquids: the serum coagulates if exposed to a greater degree of heat, but milk does not; and yet this milk, after it has flowed with the blood for twenty-four hours,

hours, turns to serum, and then acquires the faculty of concreting. This is wholly owing to the action of the vessels of the liquids, and especially of the lungs. The more remote therefore the liquids, derived from food, are from this last degree of perfection, the less power have they to run into concretions. Chyle will hardly coagulate, but milk, which is nothing but chyle that has flowed some time with the blood, may be separated into three parts, cream, whey, and curd, which curd, when the whey is entirely pressed, becomes cheese; so that the plastick nature of the blood begins here to shew itself in the milk. Upon eating of milk, this curd is separated in the stomach and bowels from the other parts, and would fill the intestines with very bad viscidities, if it were not divided by the bile; from whence so often arise the swelled bellies of infants. Being corrupted by its continuance in this warm passage, it frequently brings on very putrid diarrhoeas; for cheese, though separated from a milk disposed to turn sour, seems to have the most animal part of the milk in it; for when it is grown hard it becomes acrid, alkaline, and yields by a chemical analysis very near the same particulars as the parts of animals.

S E C T. LXXIX.

SUCH animals as feed upon other animals have their juices easily disposed to become alkaline.

For in these the chyle retaining the nature of the aliment inclines to an alkaline state; for which reason a fish-diet cannot be supported for any length of time, unless sauce or acid sauces be added to it, or some other aciescent food be taken with it. Thus all the creatures which live upon prey have almost constantly a fetid breath. The great author of these aphorisms

rifms in a very severe fit of the rheumatism endeavoured to live upon nothing but veal-broth without any salt, in hopes of thereby easing the tormenting pains which he endured ; but he found himself under a necessity of laying it aside within five days, and was forced to have recourse to whey, on which he lived alone for many days, and found great relief.

S E C T. LXXX.

IF by the powers of the body (58) the aliments be reduced to such liquors as are found in a strong and healthy body, after four and twenty hours abstinence from meat and drink ; if then these are left to themselves in rest and heat, or if they are strongly moved, they will acquire a beginning putrefaction, which is constantly the same.

In the foregoing paragraphs we have treated of the changes which happen to the humours derived from the aliments, before they have by the action of the body put on the nature of our liquids ; in this it is explained, how the same humours are changed after they have laid aside their alimentary nature, and been converted into humours like our own. Lower has observed (a), that upon bleeding within four or five hours after a large meal, there shall be discerned a considerable quantity of a milky chyle intermixed with the blood, let it be drawn from any vein or artery whatsoever ; and that this observation shall hold good, whether the blood be taken from men or other animals ; but that when the chyle had circulated with the blood some time longer, it lost its whiteness, and was attenuated into serum : so that if a vein was opened at a considerable distance from a meal, there would be not the least sign of any milky appearance.

but

(a) De corde, pag. 238.

but the serum only with the coagulated part swimming in it.

For this reason the nature of milk is very different according to the different time of its being drawn off after a meal. For if the crude milk be first drawn off, what comes some hours after has scarcely any acidity in it; and the cheese made from it is disposed to be putrid and fetid, of which kind is the cheese that comes from Leige, which some people so much admire.

When therefore no food shall have been taken down for twenty hours or more, there is then nothing left remaining of the nature of the aliment, but the whole has acquired the nature of our proper humours. Now all our liquids, if exposed to the heat of the common air, will putrefy, though a man live merely upon acid substances or such as are disposed to become so; for which reason they are all of them but one degree distant from a state of putrefaction. In health indeed there is nothing in the body that can become absolutely putrid, being thrown out of the body by the excretory passages, before it can arrive at this state.

But all animal humours will putrefy much the sooner if the animal use any strong exercise. Thus after hard running, or any excessive labour, how rank is the sweat, how strong and fetid the urine? If a woman that gives suck falls into an acute fever, unless she drinks very plentifully, her milk, in a few hours, will become thin, yellowish, salt, and have something of an urinous taste.

S E C T. LXXXI.

BUT in food of the animal kind, there is that disposition to putrefaction already, even before any change was wrought on it in our body.

A strong

Sect. 82. a spontaneous alkaline CAUSE. 223

A strong healthy woman lives on bread, milk, beer, and the summer-fruits, and forms her milk from these, which, if she abstain from all food for twenty-four hours, may degenerate into an alcalescent nature. But this effect will be sooner produced, if the aliment she takes down be of itself disposed to be of an alkaline nature. For which reason it is, that in great mens houses, where the nurses are frequently obliged to live upon broths only, they shall lose their strength, and have a salt subalcalescent milk; and as soon as they return to ascescent diet, their spirits shall return, and their indisposition leave them.

S E C T. LXXXII.

THIS putrefaction (80, 81) signifies such a state of humours, wherein the water in a great measure exhales away; the saline part being attenuated and deprived of its acid, or even changed, and separated from its earth and oil, becomes acrid, volatile, alkaline; and the oily substance shall in part grow thinner, and receding from its earth, and mixing with that sharp salt, shall become acrid, volatile, and fetid; whilst the remainder being most pertinaciously joined to the earth, which now wants its water, salt, and other part of oil, shall change into black and dense fæces, incapable of passing through the vessels in the ordinary course of the circulation.

The alterations are here described, which happen to the humours of animals, whilst they putrefy.

The water in a great measure exhales.] A whale being thrown on shore here, that vast body by putrefaction wasted all away in a few weeks, so that nothing was left of it but naked bones: such therefore was the power of putrefaction, as to render the whole substance

substance of it volatile. Now as water is the most moveable part of all the humours, and comes away first in every chemical process, this will therefore be the soonest carried off.

The saline part.] The blood of a sound animal, when fresh let out of the veins, shews no sign of having any alkaline salt contained in it; if it be dropped into the eye it gives no pain: but if it be kept in a like heat with that of the body but three days, it will corrupt, stink, become acrid, and yield by a gentle distillation a volatile alkaline salt, though the native salt of the blood is neutral and much more fixed; its nature therefore is entirely changed by putrefaction. That putrefaction will also change acid salts into alkaline, may be learnt from that very acid plant sorrel, which when putrefied yields a volatile alkaline salt.

The oily substance also, &c.] The volatile alkaline salt drawn from putrefied animals by distillation never comes off pure, but is yellowish and foul, being intermixed with a very subtle, acrid, fetid oil: the oil of the blood, therefore, which is naturally so fixed, becomes so volatile by putrefaction, as to rise with the volatile alkaline salt by a gentle heat.

But the other part of the oil, &c.] For it is not the whole quantity of oil, but a certain part only, that is made volatile by putrefaction: the rest unites with the earth, and very tenaciously coheres with it. From putrefied urine is drawn a thin oil, together with a volatile salt; but in the residuum there is left a large quantity of oil, that does not yield to the hottest fire. So also in atrabilarious diseases we see, that when the most moveable part of the blood are carried off, the remaining tenacious pitchy part, that adheres most stubbornly like the dregs of oil, shall oppress the abdominal viscera, and bring on the most obstinate chronical diseases.

S E C T. LXXXIII.

INSECTS, fishes, amphibious creatures, birds, beasts of all kinds, reptiles, and even men, of their own nature constantly incline to this putrefaction (82), but never turn acid.

All the known animals except a few juiceless insects (for moisture is required to putrefaction, and the parts of animals never putrefy if they are dried), putrefy, if exposed to the heat of an air, which shall cause the liquid to rise in the Fahrenheitian thermometer to any degree between the 32d and the 92d: the greater the heat is within this limit, so much the sooner for the most part will the putrefaction begin (for beyond the 92d degree the heat rather dries up all moisture and so hinders putrefaction), and the nearer the descending liquid approaches to a like degree of coldness with that of ice, the slower the putrefaction comes on. In fishes it generally comes on very soon; more slowly in other animals. Nor does it appear by any experiment, that the parts of animals have ever degenerated of themselves into an acid. This therefore it seems may be taken for a general rule.

S E C T. LXXXIV.

THE antecedent causes of this putrefaction (82) are: 1. Feeding upon animal food, except the milk of grazing cattle (78), especially upon insects, fishes, birds of prey, and alcalescent vegetables. 2. A fulness either of good blood, or of blood acceding towards putrefaction. 3. The great strength of the vessels, viscera (50 to 54), bile. 4. Stagnation or too much

much agitation through the animal motion either growing languid or being raised too high. 5. Great heat affecting the body frequently and long.

The action of the body upon the aliments we take down, though they can naturally incline to acid and not to a putrid alcali, may so change them, as to render them like to sound humours, and make them assume the nature of a beginning putrefaction (§. 80). If the aliment therefore inclines to putrefy of itself, it will conspire with the action of the body, and that disposition to putrefy will come on the faster. For this reason no man can live long on flesh or fish alone without salt, or some acid or acefcent vegetables taken with it; he would in this case soon languish and loathe his food: and yet there are animals that live on flesh alone and drink nothing. This Gesner affirms of eagles, and observation now shews it to be true; yet by experiments made on men, it has appeared, that they cannot enjoy their health long, if they live only on alcalescent food.

Of how great efficacy good blood is in assimilating the aliment, we have already observed §. 25. Numb. 1. that being the chief means of changing the crude aliment into our humours. For this reason the most healthy and plethorick persons are most liable to putrid diseases, when such a constitution is epidemical, whilst weak people, subject to an ill habit of body, and such as are full of mucous and viscid humours, are scarce affected; the condition of those therefore that are perfectly well is the most dangerous. If a plethorick man use hard labour, his sweat is very rank, his urine red, acrid, and almost putrid. Too great heat in those bodies, which abound too much with good blood, greatly increases this tendency to putrefaction.

3. The two chief means of assimilation are the mixture of a little crude matter with a large quantity of concocted humours, and the action of the vessels
and

Sect. 84. a spontaneous alkaline CAUSE. 227

and viscera ; of the former we have treated in the preceding number, and shall speak to the latter in this. The chyle mixing with the blood flows together for some hours, 'till by the continual action of the vessels and viscera it is changed into serum and blood ; and the stronger that action is, the sooner is this performed. For which reason strong men, that use hard labour, are capable of digesting hard sour bread, four butter-milk, and flesh hardened with smoke and salt, and turning it into good blood, whose property is always to incline to putrefaction and never to turn acid. Should such men eat broths, tender flesh, &c. they would presently grow faint, unless by taking down acids they conquered the too great disposition which this kind of food has to putrefy.

Bile.] Of all the liquids of the body in health, except such as are excrementitious, the bile is the most acrid, and inclines most to putrefy. For which reason dead bodies corrupt sooner about the parts where the bile is found, than they do in any other place. In acute diseases it speedily degenerates, and frequently produces most terrible mischief. The bile, when mixed with the chyle in the duodenum, impresses upon the food what may be called the first character of humanity, and changes the acid or acedcent part of it into an opposite nature. This therefore is a principal instrument in the formation of the chyle. For this cause fishes, which are of a cold nature and have no teeth, have the most acrid bile. But if this bile either exceeds in quantity, or begins to putrefy, it brings on an universal corruption, and gives rise to the most acute putrefying diseases.

4. The want of motion in our liquids, or an excess of motion in them, will both produce putrefaction ; and thus two directly opposite causes will produce the same effect.

A man shall live to eighty years and upwards without any putrefaction ; he then dies, and all motion ceases, and all the liquids stagnate, and within three

days or less the body shall putrefy. The same thing shall happen to the most healthy man when drowned, in which case the liquids remain the same, only motion is wanting, and putrefaction soon follows.

Too great agitation on the other hand brings on putrefaction much sooner. For an acute fever is capable in four and twenty hours of inducing such an universal corruption, as may plainly be seen from the fetid urine, the cadaverous stools, and the very stinking breath; all which sufficiently shew, that a general corruption prevails within.

Men that live in ease and indolence often die of a putrid scurvy, and their viscera all rotten: and violent exercise shall raise a very high fever, that shall be attended with an universal tendency to putrefaction.

5. Where the heat is so great as to carry off all the moisture, then dryness shall follow, which always prevents putrefaction, otherwise the greater the heat, the quicker is the putrefaction. Flesh may be kept in winter-time for many days, which in the heat of summer shall soon be converted into a putrid substance: especially if the air be moist at the same time. Hippocrates reckons among the diseases of the summer, many which arise from the putrefaction of our humours; such as continual burning fevers, exulcerations of the mouth, putrefactions of the genital parts (a). When sea-faring men are becalmed and forced to lie still for want of wind in very hot climates, they are liable to be affected with the most putrid diseases. From which circumstance we learn how necessary the refreshment of a cool air is to such persons as labour under putrid acute diseases. Galen, describing the nature of putrefaction, says (b), *Putredo est mutatio totius substantiæ corporis putrescentis ad corruptelam ab externo calore; non enim a proprio calore corrumpitur quidquam, &c. docent animalia sana per multos annos sine putredine viventia, si servetur earum proprius*

(a) Aphor. 21. Sect. 3.

(b) Meth. Med. Lib. XI. cap. 8. Charter. Tom. X. pag. 254.

Sect. 85. a spontaneous alkaline CAUSE. 229
prius calor, &c. " That it is a change of the whole
" substance of the putrefying body to corruption by
" external heat ; for nothing is corrupted by its own
" heat ; as appears by animals living uncorrupt for
" many years, if their own heat be preserved, &c."

S E C T. LXXXV.

IN the first passage it occasions thirst, a loss of appetite, fetid belchings, a stinking breath, smelling strong of rottenness and corruption, bitterish putrid foulness in the mouth, tongue, palate, fauces, nausea and vomiting of putrefied bilious matter, a loathing of every thing but what is watery or acid, putrid crudity, a bilious diarrhœa, iliac inflammatory pains, with the sense of a troublesome heat.

Here follows the effects of putrefaction produced in the human body, and first of all, the effects which are observable upon any putrid matter inhering in the *primæ viæ*.

Thirst.] This is the constant attendant upon any thing that is putrid here : for by much drinking nature endeavours to wash it away. This clearly appears in hydropical persons, who are seldom thirsty at the beginning, 'till the waters are corrupted by stagnation and a long continuance in the body, and then there follows an unconquerable thirst. Hippocrates therefore reckons the want of thirst a good symptom in a hydropical case. Such as have the liver corrupted are extremely thirsty, from the putrid *fomes* residing here.

Loss of appetite.] This may arise from many other causes, but when thirst is joined with it, it generally proceeds from this cause.

If a man in perfect health happens to be standing by the body of a dead animal just at the time that

its distended belly bursts, he will hardly avoid fainting away, and dislike all kind of food for a considerable time after. If a man swallows the least bit of a rotten egg, an universal nausea shall presently succeed. What then must be the consequence, where such a putrid mass lies near the stomach, dispersing its putrid steams through all the inner parts. Hence proceeds that insuperable loathing of food in diseases which arise from the lodgment of a putrid bile in the parts here adjacent.

Fetid belchings.] We have already explained from whence belchings arise §. 63. When a man belches, the smell of what is in the stomach first strikes his nose; if it be putrid, it proceeds either from the aliments putrifying there, or from some corrupt cause residing in the viscera.

Foulness of the mouth, tongue, &c.] A prudent Physician never leaves a patient 'till he has inspected his tongue and the inside of his mouth, which so fairly shews the state of the viscera, whose office it is to form the chyle, as also of the lungs. Nothing exhales from the mouth of a man in health but the most limpid dew. But in diseases where the unpassable humours obstruct the extremities of the exhaling vessels, the back of the tongue begins to be rough and dry, its colour turns pale, yellowish, brown, and at last black; nay sometimes all the gums and teeth are covered with such a crust: this is a very different thing from a thrush (with which it is often confounded) and may properly be called by the name of filth, which when a due perspiration is restored is all absterged by the force of the vital liquid, and the usual clearness of the tongue returns. When this foulness is owing to inflammatory obstructions, it is generally attended with a great dryness; but if it proceeds from a putrid viscous obstructing matter, there is commonly a greater degree of moisture, unless these two causes concur, that is, an inflammatory density and putrefaction too, as is often the case in
acute

Sect. 85. a sponaaeous alkaline CAUSE. 231

acute diseases. And farther according as the surface of the tongue is, so is the inner surface of the œsophagus, stomach, &c.

A stinking breath, &c.] When any putrid matter is lodged in the *primæ viæ*, and especially near the stomach, it often causes surprizing diseases, that disorder the whole nervous system, and pervert every action of the brain; and this not so much from the putrid humours being resorbed by the veins, and carried in the course of the circulation to the brain, as by the exhalation of its poisonous steams. If putrid bile be collected and lodged in these passages, or be produced and fixed here by any disease, the violent pains of the head, vertigo's, deliriums, wildness, and rage, &c. which ensue, would almost tempt one to believe, that the cause and seat of the disorder lay in the head; but all the mischief ceases at once, when the foulness collected is once thrown out of the stomach by a gentle vomit. For which reason Hippocrates reckons a vertigo, attended with a dimness of sight and a pain near the upper orifice of the stomach, among the signs that forerun a bilious vomiting: and as the fetid smell arising from a putrid body is capable of throwing the healthiest man into a fainting fit, and taking away all his strength in a moment, so may such a putrid matter within, by its offensive smell and spirituous kind of steam, disorder all the parts within.

Nausea and vomiting, &c.] Bile, the most acrid of all the humours, is the soonest subject to putrefaction, so that if there be any thing putrid lodged in the *primæ viæ*, it is changed immediately. Farther, putrefaction here entirely takes away the appetite, so that persons who have this complaint, can scarce bear any food but what is watery and acid, which easily pass off, and for this reason the stomach is hardly distended, in which case the pylorus lies always open, and there is an immediate commerce between the stomach and the duodenum; which at last, as it receives all the humours secreted by the liver, the pancreas, and gall-

bladder, but does not so easily transmit them along, being closed by so many wrinkles, will make these liquids apt to regurgitate up into the stomach, where the air has a free access, and by this means will expose them to a sudden putrefaction; this is the cause of that nausea and vomiting of bilious putrid matter in the autumnal epidemick fevers, which so usually rage after the excessive heats of summer, and which, unless the corrupt bilious matter be thrown off by nature or art, end in a most putrid diarrhoea, and frequently carry off the patient.

A loathing of every thing but what is watery and sharp.] By observations both on men and beasts it appears, that a disease often directs to the application of a proper remedy, though otherwise unknown, and creates an insuperable longing after some particular things and an aversion to others. Why this should be so we know not, but we find the fact to be certain by experience. When the body is dried up with violent heat, thirst compels us even against our wills to seek a remedy. If any thing putrid is lodged in the *primæ viæ*, the patient presently loathes every thing that is apt to putrefy. Offer roasted meat to a man in a putrid fever, he cannot bear either the sight or smell. Offer him lemons or oranges, he greedily snatches at them. And this is still the same case, whether the patient be himself a Physician of judgment, or an innocent child. Now it is a great instance of a Physician's discretion to observe in diseases these particular inclinations. The Physicians, who, from a preconceived hypothesis denied all drink and condemned all acids in very hot diseases, were very unfortunate in their cures. Nature, sufficient of herself to supply all her wants, calls for water and watery substances to wash away the putrid matter by urine or sweat, and for acids to correct it.

Putrid crudity.] Though the aliment be so changed by the power of the body, that by rest and heat, or great motion, they would begin to putrefy, §. 80.
yet

Sect. 85. a spontaneous alkaline CAUSE. 233

yet putrefaction is never found in the humours of a sound body. Every thing therefore that is actually putrid must be a crudity : for the concocted humours are bland, neither alkaline nor acid. If the aliment, therefore, or the liquids which are found in the *primæ viæ*, turn to putrefaction, there arises here a putrid crudity ; which will increase every moment, because of the free access of the air, the heat and moisture of the *primæ viæ*, and because the whole power of the body conspires with it by its action on the aliment ; for by this power it is, that aliments, the most remote from putrefaction, are converted into the nature of our humours, which are liable to putrefaction ; how much more then will this power, when it is acting on a matter that is already putrid, increase that corruption.

A bilious diarrhœa.] When any thing putrid is lodged in the *primæ viæ*, the bile presently begins to corrupt, and by its poisonous stimulus brings on very putrid stools, in which there is brought away a very fetid matter resembling melted cheese. In acute diseases it often happens, that the bile, when it is corrupted by the violence of the disease in the beginning, shall cause a perpetual nausea ; and if not thrown off by vomiting, or corrected by acids, will in the end bring on a very putrid bilious diarrhœa, which is then so dangerous, from the patient's strength being already so much reduced by the violence of the disease. Bellini has observed, that a few grains only of the yolk of a rotten egg is capable of bringing on the most violent hypercatharsis.

Inflammatory illiac pains.] Every kind of acrimony may irritate the nerves dispersed through the intestines, from whence may follow their spasmodick contraction and inflammation : especially when by the soapy virtue of the acid bilious matter the mucus is abraded, that defends the very fine extremities of the nerves, which are spread over the internal coat of the
intestines,

234 The DISEASES from Sect. 86.
intestines, and causes them to become much more
sensible.

A troublesome sense of heat.] How much heat is generated by putrefaction appears from hay thrown into heaps, which by putrefaction will break out into flames. In the continual fevers, which from their effects are called putrid, the principal diagnostick sign is an intense heat. In violent fevers, whilst the external parts are cold, the patient shall be inwardly parched. And how suddenly in these fevers shall an universal putrefaction ensue? The legs of an hydropical person, though cold as marble 'till the stagnating lymph begins to putrefy, shall then grow hot and be inflamed. An infant that died of the plague continued warm for two days after (a).

S E C T. LXXXVI.

WHEN in the blood it produces the putrid dissolution of it; an alkaline oleose volatile acrimony; it renders it unfit for nourishment, and prone to waste; it destroys the smallest capillary vessels; and for this reason it disorders, depraves, and destroys, all the actions of both the solid and liquid parts; whence the circulation, secretion, excretion, become irregular; and consequently burning fevers ensue, the urine with every other secreted liquid grows putrid, inflammations follow, gangrenes, mortifications, death.

The putrid dissolution of it.] The blood of a sound man, within a few minutes after it is drawn from the vein, coagulates into a red homogeneous mass; from which, after it has stood some time, a thinner serum is separated, the thick red part still remaining concremented. And yet this kind of blood, if exposed to a resembling

(a) Vander Mye de morbis Bredanis, pag. 8.

Sect. 86. a spontaneous alkaline CAUSE. 235

bling heat with that of the body for some time, shall begin to putrefy and grow thinner, and never after coagulate again. When the bile in a jaundice is thrown back into the blood, if the disease be of long continuance, the blood will be dissolved thereby and disposed to putrefy; so that a dropsy shall ensue from the blood's being too much dissolved. In a putrid scurvy the blood is so dissolved, as not to be kept within its own vessels, but shall cause ecchymoses, spots, and violent hæmorrhages. At the siege of Breda, when the plague raged in the town, the blood of the infected appeared to be livid, and fetid, and would not coagulate (a).

An alkaline oleose volatile acrimony.] The blood, probably, never actually putrefies in the body whilst the man is alive, (for death would come on first by the destruction of the fine vessels in the cerebrum and cerebellum) yet it may so nearly approach to this state, that it shall immediately putrefy when exposed to the air, as may be seen in the gums when they are affected with the putrid scurvy, for here the bloody matter flows from the eroded vessels stinking like a dead carcase.

Unfit for nourishment.] The white of an egg, which we are certain nourishes the young chicken, has a remarkable tenacity; the serum of the blood, which appears by experiments to bear a great resemblance to the white of an egg, has a like plattick cohesion. Something like it also begins to be formed in milk, as may appear from the cheese it contains; so that such a cohesion in our humours seems necessary for the nourishment of the body; but this is destroyed by putrefaction. The white of an egg putrefying becomes as thin as water; the serum of the blood when putrid does no longer coagulate, though exposed to the fire; and in the diseases arising from some putrid matter lying in the body, all the humours are dissolved, nutrition fails, and the patient dies of a
flow

(a) Vander Mye de morbis Bredanis, pag. 14.

slow consumption; as is plain in phthical cases, where the night-sweats, the colliquative and putrid diarrhoea, atrophy, and death, arise from the blood's being too much dissolved.

Prone to waste.] This particularly appears in that kind of wasting, which the English term a consumption; in which disease the body consumes by degrees, without any remarkable defect in the lungs. It seems to take its cause from living too much upon flesh-meat, whereby the humours inclining too much to an alkaline indisposition, lose their plastick tenacity; by which means the patient dissolves in sweats, and wastes away by degrees.

It destroys the smallest capillary vessels.] The urine carries off the salts of the blood when grown too acrid; when therefore this secretion or excretion is hindered by any cause, this depuration of the blood is not wrought. This acrimony is increased by the action of the vital parts every moment; and the disorder shews itself first in the very tender vessels of the brain and cerebellum; for which reason after a long ischury there generally ensues a drowiness, delirium, and death. And possibly it may be from this cause, that the very subtle poison of the plague, which induces an universal putrefaction, shall kill so suddenly, by destroying the very small capillary vessels.

And for this reason all the actions, &c.] To perform the actions necessary to health, there is required a due cohesion in the solids, and a consistence in the fluids proportional to the vessels they are to flow through. But when the humours are become too thin by putrefaction, they enter into other vessels than they ought, and of bland become acrid; by which means the body declines from the rules of health in the discharge of every function. In very acute fevers, where there arises so sudden a putrefaction in all the humours, the functions are all injured immediately, and of consequence all the humours are changed into a worse state than they were in before.

Sect. 86. a spontaneous alkaline CAUSE. 237

fore. For in the very beginning of these diseases, the quick and difficult respiration, the very swift and oftentimes unequal pulse, shew plainly that the vital functions are disordered; as the animal appears to be also from the extreme weakness, delirium, drowsiness, &c. usually attending these cases; and again, the lost appetite, the thirst, nausea, and vomiting, plainly point out the disorder of the natural functions; the saliva, bile, sweat, urine, soon after degenerate; and thus nothing healthful being left in the body, the event is commonly so fatal.

Burning fevers.] Hippocrates has observed (*b*), that burning phrenitick fevers follow a course of gentle (*c*), moist, southerly winds; and that is the constitution of the air likewise that so much disposes to putrefaction, so that in a moist warm air flesh will dissolve in a few days into a putrid matter. Where the exalted *atrabilis*, which naturally is so obstinately fixed and tenacious, is dissolved by any cause whatever, corrupted, and mixed with the blood, there will follow a most violent fever that carries a sudden destruction to all around it.

The urine, and every liquid that is secreted, putrid.] These liquids all follow the nature of the blood from which they are secreted. By the appointment of nature the urine is to wash away, and carry off the more acrid salts and oils, and whatever approaches near to corruption. When the blood therefore is putrid, the urine will have the same taint; as also the sweat, &c.

Inflammations, suppurations, &c.] We learn from the most certain observations, that whatever is acrid may cause an inflammation either in the whole body, or in any particular part, by its stimulus: putrid acrimony, therefore, may bring on an inflammation. Besides, the several sorts of humours being dissolved by putrefaction,

(*b*) Epidem. 3. Charter. Tom. IX. pag. 259, 260.

(*c*) Μα'λακον, Galen in his Commentaries explains by ἀ'τταν ὁ δ'ι'μον, serene, without winds, and warm.

putrefaction, will enter into other vessels than such as properly belong to them, and often will not be able to pass through the extremities, from whence will arise another cause of inflammation occasioned by putrefaction. The spleen of a calf fresh killed was applied for twenty-four hours to the nape of a man's neck for an ophthalmia, and by the heat and moisture of the body it grew fetid and putrefied; and the place to which it was applied had all the signs of a violent inflammation. But if an inflammation be once raised, the consequences of it will follow of course, to wit, suppuration, gangrene, or sphacelus, as shall hereafter be shewn in the account of an inflammation. This would not be quite so terrible in the external parts, but must be very dangerous in the smaller vessels of the most tender viscera. In very acute fevers it is observed, that such malignant humours are thrown off by abscesses on the extremity of the body as cause the present death of the part, and a sphacelus which shall extend even to the bone: as Hippocrates has observed in his prognosticks, that such parts shall turn quite black and fall off, and yet the patient survive, provided he seems to bear it easily, and any other good symptom appears (*d*).

S E C T. LXXXVII.

FROM these things (76, 79, 80, 81, 82, 83, 84, 85, 86) the diagnosis and prognosis, as well as the cure of the disease, clearly appear.

How to deduce the diagnosis, prognosis, and curative indication, from the history of the disease before given, has been already shewn in one general example, §. 27. Thus in this disease the causes foregoing, §. 84. and its effects, §. 85. and 86. demonstrate its presence; the prognosis will then be, that all these
bad

(*d*) Charter. Tom. VII. pag. 624.

Sect. 88. a spontaneous alkaline CAUSE. 239

bad circumstances are to be feared, which faithful observation has shewn to follow from it; these are related, §. 85. and 86. then from these being well understood whatever is requisite to a cure may easily be deduced.

S E C T. LXXXVIII.

WHICH is performed, 1. By such solid and liquid food, as shall speedily turn acid, or are already so, of which kind are the mealy substances boiled in water, or digested 'till they begin to corrupt; milk and its productions, as being drawn from herbs, the summer-fruits, their acid crude juices, or the same fermented and turned into wine or vinegar; 2. By acid medicines from crude or fermented vegetables, or by salts and sulphur turned into acids by the force of fire; 3. By the salts that absorb alkali's, such as sal-gem, sea-salt, and nitre; 4. By watery diluters; 5. By mild obtundents, such as mealy vegetables, emulsions or decoctions; and the much commended boles, consisting of a concealed balsamick acidulous part, and a certain viscid part that is exceedingly demulcent; 6. By soapy abstergent acid suboleose medicines, oxymel, the sapæ acetosæ, robs; 7. By rest, sleep, vapour-baths, or fomentations.

1. It is plain that the whole cure is two-fold, and consists either in expelling the alkaline putrid matter out of the body, or changing it so as that it shall be capable of doing no farther mischief; and then in giving such meat and drink, as shall never putrefy of themselves, but rather lean to the opposite state of acrimony, that is, which shall be apt to turn acid; of which sort are all the before-mentioned substances; namely, the several kinds of grain and ripe seeds
which

which may be ground into flour. For these diluted in water will turn sour by a gentle heat, some sooner, and others later, the decoctions of oats and rye soonest of all, and next of barley; but rye especially either boiled or steeped in water will turn to an acid, that is acrid enough. The artificer knows, that tin will not stick to iron-plates, unless their surface be extremely smooth; to this end they steep the iron-plates in water made acid by an intermixture of a few grains of rye (a). Hippocrates gave a ptisan, the cream, or juice of barley in all acute diseases, as may be shewn from many places in his works.

Milk and its productions.] Pure milk is not altogether safe in putrid diseases; for though it is all apt to turn acid, if the animal, from whence it is drawn, be fed with herbs, yet it has cream in it which may grow rancid, and cheese which partakes of the animal nature, and may putrefy. In very acute diseases therefore it is not to be allowed, unless diluted very much with water, or in the form of whey, and especially the whey of sour butter-milk strained through an Hippocrates's sieve: this thin whey, so agreeable for its acidulous taste, is of excellent use in all putrid diseases.

The summer fruits.] Whoever is afflicted with a disease of this kind is naturally led to desire eagerly these grateful fruits. Many years ago almost all Physicians in general opposed this practice; and when the celebrated author of these aphorisms allowed cherries, mulberries, and currants, to a person of distinction in an acute disease, it was thought a crime deserving the publick animadversion; in the mean time they, who condemned this method, daily gave the juices of the same fruits boiled up into a syrup with sugar. The juice of ripe fruits needs no preparation, it allays thirst, cools, relaxes the belly and urinary passages, and affords the greatest relief when the stomach suffers from a putrid bile. In very hot countries
healthful

(a) Acad. des sciences, l'an. 1725. Mem. 152.

Sect. 88. a spontaneous alkaline CAUSE. 241

healthful people live almost entirely on these fruits ; and when the bile is exalted by the summer heats, it is happily asswaged by these mild juices. Galen, who almost universally condemns the use of these temporary fruits, says, “ they are good for those only who “ are almost dead with violent heat and long jour-
“ nies ; that then they relieve the parched state of
“ the body by moistening it, and if they are eaten
“ cold, are moderately cooling (b) ;” *illis solis prodesse, qui æstu vehementiori & longiore itinere sese confecerint ; tunc enim juvant corporis squalorem humectantia, & si frigida sumantur, moderate refrigerantia.* Thus he unwillingly acknowledges the excellent use of the fruits which he had condemned. These juices are either naturally acid, as in currants, some cherries, &c. or speedily become so by fermentation, and then they acquire the nature of wine or vinegar. But wine itself is good in these diseases, and even in the most acute, especially the acid sorts ; but then they must be very much diluted with water. In Germany it is customary to preserve the flesh of boars from putrefaction in Rhenish wine.

2. From vegetables.] There are very many vegetables which naturally contain an acid. as all the species of sorrel, wood-sorrel, tamarinds, &c. which are to be sold in every shop, and will serve to compose the most agreeable and efficacious medicines. Hither is to be referred the acid prepared by fermentation, *i. e.* tartar and vinegar, which excels almost every thing beside ; from vinegar are prepared the oxycrate and oxymel, so much commended by the Antients. Vinegar may be made from all fermented liquids, but from none better than wine : for all the constituent parts of the wine seem to be in the vinegar, only disposed in a different manner. Vinegar is reckoned by all among the best prophylactick medicines to keep

(b) De aliment. facult. Lib. II. cap. 2. Charter. Tom. VI. p. 326.

keep off the plague, as its smell is so reviving in all putrid diseases.

Or salts and sulphur, &c.] Almost all the acid vegetables, and especially vinegar, dissolve the blood; putrefactions also bring on too great a dissolution of the humours; when then there is either a dissolution of the humours from putridity, or there is reason to apprehend it coming on, the acid spirits drawn by fire from sea-salt, nitre, vitriol, will then be of the greatest service; these resist all putrefaction most powerfully, at the same time not dissolving, but rather coagulating the humours. The spirit of sulphur *per campanam*, as it is called, is singularly serviceable in this case, being the purest fossile acid without any metalline substance intermixed with it.

How great the efficacy of these fossile acids is we are taught by Sydenham, who in the worst sort of the confluent small-pox gave spirit of vitriol in the common drink with the greatest success, after other remedies had been tried in vain (c); in which disease the whole body dissolves into the most putrid mass; and from whence it appears, how much these fossile acids resist putrefaction.

3. The absorbents of alcali, &c.] These salts sprinkled on the flesh of animals prevent putrefaction, as we learn by daily experience. They are always, therefore, of very good use, unless the motion of the humours be too violent, for then the danger is, lest the blood, loaded with a great quantity of these salts, should become more acrid, and being thereby more swiftly moved, should destroy the very small vessels. Yet nitre, the lightest of them, is easily overcome by the powers of the body, and is therefore preferred to the rest. These salts, dissolved in water, and applied to any of the external parts corrupted with a gangrene, will keep off all putrefaction.

4. By watery diluents.] According to the constitution of nature, whenever the salts become too acrid,
and

(c) Sydenham, pag. 299.

Sect. 88. a spontaneous alkaline CAUSE. 243

and the oils too thin and almost putrid, they are carried off by urine, and sometimes by sweat; it is of the greatest use therefore to wash them away by giving a large quantity of watery diluters; hereby the quantity of urine is increased, and a proper vehicle supplied for discharging the matter by sweat; besides, in all putrid diseases, whilst the patient continues in his senses, he thirsts very much for water; in this therefore nature points out the way we ought to proceed.

5. Mealy emulsions or decoctions.] These, by reason of the water they contain, dilute; but by means of the soft oily gluten residing in them they inviscate whatever is acrid, and render it inactive, and for this reason are so very serviceable. All the mealy seeds when bruised and pressed, yield a large quantity of a very smooth oil; but when they are pounded with water they give a very soft milky liquid, called an emulsion in the shops, which has the oil in it, but so changed as to turn acid rather than rancid; yet the virtue of the oil, whereby it inviscates and blunts whatever is acrid, is still left remaining in the emulsion, and there is no fear of its ever growing rancid.

The much commended boles.] These medicated earths, as they are called, were much commended in the time of Galen, especially that which was dug up in the isle of Lemnos.

Dioscorides thought (*d*), that goat's blood was mixed with this earth, and that then it was made into troches, and sealed with the image of a she-goat. Galen made two painful journies to Lemnos to discover the nature of this earth, and found, that goat's blood was never mixed with it, but that it was a rat earth; and that when the thicker parts were carried off by washing, it was dried to the consistence of wax, divided into small parts, impressed with the seal sacred to Diana, and so sold (*e*).

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There

(*d*) Lib. V. cap. 113.

(*e*) De Simpl. Med. Facultat.

Lib. IX. cap. 1. No. 2. Charter. Tom. XIII. pag. 247.

There are many such earths in the shops at this day, of which the best is perhaps what is called the Armenian bole; which feels fat and soapy to the touch, is of a pale red colour, has a little, and not disagreeable, smell, and is easily pounded into a very smooth powder; it melts in the mouth like butter, and is thoroughly diluted with the spittle; to the taste it has something lightly aromack, and at the same time something drying. There is an acid in these earths wonderfully concealed, as appears by chemical observations. For the vague acid, which is termed fossile, adhering in the bowels of the earth, forms different compositions, according as it is united to different bodies; for allom, vitriol, sulphur, yield an acid, which has very nearly the same qualities in every respect. But because vitriol yields it in the largest quantity, it is therefore called vitriolick. This acid mixed with sea-salt, sal-gem, or nitre, expels their acid spirits, unites with the part that is then left, and constitutes a new sort of salt: these same salts mixed with Armenian bole yield the same spirits with a strong fire; which is not because the intermixture of the bole hinders the salts from flowing, for with chalk or sand it will not succeed: whence it is concluded, that there is a vitriolick acid in these fat earths, which being made active by the fire, cast out the acid spirits of these salts. It is no objection, that its mild taste indicates no acrimony, for sulphur that is quite insipid contains a great deal of this acid.

From hence appears the great use of these medicated earths, for they resist all putrefaction by their latent acid, and by their harmless mildness they are extremely demulcent. Whence they are of such excellent use in putrid dysenteries, if given in a due dose, *i. e.* in an emulsion as it were, which shall have one ounce of it to one pound of water, and then be taken by spoonfuls; if only a few grains be given at a time, they are of no service.

6. By

Sect. 88. a spontaneous alkaline CAUSE. 245

6. By soapy aftergents.] In acute diseases the fat is dissolved by the great heat and motion attending them, and mixes with the blood, and thereby causes as it were an oily plethora; this oily disposition cannot be easily thrown out of the blood by drinking only water and watery potions, and naturally grows more acrid every moment, the longer it remains; to this end therefore, such soapy substances are added, as make the fat capable of mixing with water. The Antients used honey boiled with vinegar; we use honey and sugar too, but more especially the acidulous robs made from the juices of elder-berries, currants, barberries, &c. which as they resolve all concretions by their soapy virtue, do also by their acidity powerfully resist all putrefaction.

7. By rest.] Muscular motion increases the circulation and attrition of the parts against each other, and these, if increased, dispose all the humours to putrefy. If a man fatigues himself with very violent exercise, his urine turns acrid, red, fetid; the same circumstance is observed to happen in acute diseases; for which reason the antient Physicians enjoined their patients, in such cases, to be kept quite still, without noise or light, that a gentle sleep might steal upon them when all their senses were thus composed.

By vapour-baths.] By this method the vessels being relaxed, the watery diluents insinuate themselves the more easily, the attrition is diminished, and all the cutaneous passages are opened to carry off those peccant humours the more easily, which by being grown too acrid would do mischief, if they were detained any longer in the body.

Fomentations.] All the skin being bibulous absorbs the remedies that are thus applied, especially if wet sponges be applied to the parotids, the arm-pits, the groin, &c. for in these places especially the skin is bibulous, and the great veins that run along there soon mix the absorbent humours with the blood.

S E C T. LXXXIX.

WHENCE it appears when and why acrid belchings following after fetid ones are of service? Why, and in what case, men recovering from diseases complain of a troublesome taste, like that of sal-armoniac? Why it is a good sign in acute diseases to have the sweat smell sour? What an acid, alkaline, or bilious acrimony is? What diseases are to be properly called putrid? Why these happen chiefly to very strong plethorick people? Whether ever any humours are found truly alkaline in a living body? Very rarely indeed? as I can speak from experience. Possibly the urine, if long retained in the bladder, or absorbed by a spongy stone, may sometimes be so. Otherwise death comes on first, the pulpy-extremities of the vital parts being consumed by the acrid substances, before it becomes alkaline.

Why sour belchings, &c.] This is not always a good sign; for in infants and weak people, whose illness proceeds from an acid, these belchings are oftentimes very troublesome, and bring on a severe heart-burning; but where the belching has been rancid and fetid before, and taken its rise from a putrid matter in or about the stomach, sour belching is in this case good, because it denotes the putrefaction to be overcome, and that its opposite acid prevails in the *primæ viæ*. *In diuturnis lenteriiis ructus acidus superveniens, qui prius non erat, signum bonum*; “Acid “belching that was not before, coming on after a “long lenteria, is a good sign,” says Hippocrates in his Aphorisms (a). The reason is plain, because in a lenteria, whatever is taken down immediately passes off,

(a) Sect. VI. Aphor. 1. Charter. Tom. IX. pag. 245.

Sect. 89. a spontaneous alkaline CAUSE. 247

off, and stays not long enough to become acid; acid belchings therefore shew the stomach and intestines to be so far strengthened, as that they can retain the aliment long enough to become acid.

Why, and in what manner, persons recovering, &c.] This is what almost all persons, who recover from very acute diseases, experience in themselves; every thing they take down tastes very salt; broth, if stronger than ordinary shall taste like brine. And the same circumstance has been observed in those who recover of the plague. This taste arises from the correction of the putrid alkaline predominant quality by the acid or acescent diet, whereby it is changed into a sort of mild composite salt. And what farther seems much to contribute hereto is, that the tongue, which is always foul and rough during an acute disease, becomes very clean, and of an exquisite sense, when those foul incrustations are fallen off.

Why sweat smelling sour, &c.] In languid chro- nical diseases sweat smelling sour is an ill sign, as it shews the powers of the body to be quite spent; but in acute diseases it shews, that the disposition of the humours to a putrid alkaline nature is entirely over- come.

What an acid acrimony.] It is what arises from acescent aliment not well digested by the powers of the vessels and viscera: for all the humours that are properly animal incline of themselves to putrefy. An acid acrimony therefore is owing solely to the aliment.

Alkaline.] This takes its rise from such aliments as are prone to putrefy, and from the stagnation of our humours; for while they move in the vessels, it seems scarce possible that they should putrefy, as the very tender vessels of the cerebrum and cerebellum could not possibly bear the sharpness of such humours without being destroyed. All alkaline acrimony is first to be found in the excrements; thus there is often a true putrefaction in the stools, and a great disposition to- wards it in the urine, in very putrid diseases.

Bilious.] Of all the humours, except the excrementitious, there is none so apt to putrefy as the bile; for which reason in acute diseases it corrupts presently, and brings on a very noxious bilious acrimony. For as the circulation is increased in acute diseases, a larger quantity of bile is secreted, which not being diluted with a smooth chyle, as in health, grows acrid, and thin, and mixing with the blood, brings on an universal disorder.

Oleous.] Any oil corrupted, though very mild before becomes extremely bad. The very sweet oil of almonds corrupts in summer-time within a few days, and will change its mildness into such an acrimony, as shall occasion an heat in the inside of the mouth, in case it be swallowed. Marrow, which is of so smooth a nature, shall, when corrupted, turn the thickest bones into a carious powder by its intolerable foetor and offensive acrimony. And the tenacity, by which it sticks to every thing it touches, shall increase its malignity.

What diseases, &c.] All those, which by increasing the heat and motion, shall cause the humours to degenerate so very suddenly, as to approach very near to putrefaction. Of this sort principally, are all acute continual fevers, and especially such as the antient Physicians, from their effects, called putrid; in which very often, from the first seizure, the foulness of the tongue, the acrid, red, fetid, urine, the very stinking stools, and the rank sweats, shall give very convincing marks that there is a putrefaction begun.

Why these happen to the strongest, &c.] Because these have much good blood, great heat, and strong vessels, which speedily change the aliment into an animal nature, *i. e.* dispose it to putrefy: whence it has been often observed, that epidemick, putrid fevers, and even the plague itself, have generally attacked the strongest men; while the weak, the old, and those that laboured under chronical diseases, have escaped without harm.

Whether

Sect. 89. a spontaneous alkaline CAUSE. 249

Whether even in a living man, &c.] There is no doubt but the humours extravasated and collected either in the natural or in morbid cavities may putrefy, and the man be yet alive, especially if the air have free access to them; but we very seldom, if ever, learn from any observation, that a true putrefaction can take place in the blood itself, and the humours secreted from it, while they are moving in their vessels during life. It may even be questioned, whether ever a true alkali has been found in the urine itself, which washes away the more acrid salts of the blood, even in the most putrid diseases. I have seen one case, which inclines me to think that it may possibly happen, though very rarely. I was called to a young woman, that was grown up, in a putrid continual fever, on the tenth day of her illness, and I found her pulse low, quick, and unequal; a tremulous motion in all the muscles; the respiration deep and difficult; and yet she was, notwithstanding, free from delirium; and her urine, which had been made about three hours before, was extremely fetid. This I took away with me immediately, and poured upon it spirit of nitre, which occasioned a violent effervescence: and within eight hours after she died. This urine therefore was truly alkaline, but then it had stood three hours in the open air, and perhaps had lain in the bladder a considerable time before it had been discharged. The blood of a woman, who was afflicted with a kind of malignant erysipelatous fever; when it was let out, stunk to such a degree, that both the surgeon who bled her, and others who stood near her, fainted away through the offensiveness of the smell. This Morton affirms that he saw (*b*).

Urine long retained in the bladder.] An old corn-merchant of this city labored under an ischury, and the surgeon who used to relieve him, by drawing off the water with a catheter, being abroad, he refused to accept of the assistance of another, and so stayed 'till the

(*b*) Appar. Curat. Morbor. Universal. pag. 11.

the former came back the next day. Upon introducing the catheter, there came away so putrid an urine, that it stained the instrument, which was made of silver, with the colours of the rainbow, and farther gave the surgeon, who imprudently drew in some part of the putrid steam which issued from it, a slight peripneumony, which lasted for some days. And we are well assured from the most certain observations, that urine absorbed by a spongy stone in the kidneys or bladder, may by its heat and continuance there become perfectly putrid.

Otherwise death comes on first, &c.] For these vessels are so very small, as to escape all notice of sense, or even imagination, and consequently would be presently destroyed if exposed to the touch of such acrid fluids. They who die of a suppression of urine, have all the functions of the brain first disordered, and at length go off quietly in a fatal sleep, though sometimes they are convulsed before they die. In this case the acrid matter, that used to pass off by urine, seems by being retained to destroy these tender vessels.

S E C T. XC.

HENCE at length may be known, what harm may arise from the too great, or too little motion of the circulating humours, and how much its effects vary, according to the different places where they stop, and the humours upon which it operates? What ill effects proceed from the stagnation or extravasation of the liquids? Nor is the origin obscure of that viscid gluten, that thickens our humours, when the strong decoction of animals, prepared by long boiling, are taken down in too large a quantity; or even when the external parts of animals, and their viscid tenacious extremities are used too much, or too long:

Sect. 90. a spontaneous alkaline CAUSE. 251

long : for from hence arises another pituitous disposition, and of a different nature from that which we have already explained (75).

What harm may arise from too great or too little motion, &c.] Both will cause putrefaction : thus a gangrene, that turns every thing to putrefaction, follows upon a violent inflammation ; and the like ill effect will ensue upon a deficiency in the circulation : only in this latter case it comes on by more slow degrees, and in the former makes a swift destruction.

How much its effects vary, &c.] An increase of the circulation principally effects the parts that lie nearest to the heart, from whence in burning fevers arises the intolerable heat that is felt about the pit of the stomach ; and the greatest danger lies where the vessels are smallest, *i.e.* in the cerebrum and cerebellum. There is likewise a great difference in respect of the humours which are affected : the bile most speedily corrupts in fevers, the urine presently becomes acrid and more red, as by this the salts, which are most disposed to putrefy, are naturally carried off ; the other humours do not change so soon.

What the ill effects of a stagnation and extravasation of the liquids?] So long as the humours circulate all things go on as they should do, and a man lives to extreme old age without any putrefaction. But let a man be drowned, whereby the motion only of the humours is stopped, and let him be ever so sound, he will putrefy in a few days ; so that stagnation and extravasation dispose the humours to putrefy ; though much more slowly indeed if the air be denied a free access to them. This appears in contusions, where though the blood is effused under the unbroken skin, it corrupts not easily, because no air touches it, and the bibulous veins continually resorb the thinner part.

Nor is the origin obscure, &c.] The strongest broths are perfectly glutinous, and oppress a weak stomach

mach without increasing strength; but the thinner sorts afford a good nourishment. And yet because that which nourishes in them is what is separated from the flesh in boiling, many have thought, that the thicker they were the more they nourished; whereas at length they acquire an insuperable tenacity like glue, which the powers of the body are never able to overcome. This tenacity is much greater still, if the mucilaginous and tendinous extremities of animals are the parts that are thus boiled; of which they make glue for the use of tradesmen. Thus when decoctions of calves feet are given to phthical people with a view to nourish them, their weak lungs are oppressed with the too tenacious chyle, and very great disorders shall follow upon it.

For from thence arises another pituitous disposition, &c.] The gluten described §. 69 & *seq.* owes its origin to vegetables, especially such as are of a viscid and mealy kind. This by retaining its viscosity, either brings on very bad obstructions, or when by being diluted either with the liquids we drink, or those that flow to it from the respective glands set apart for this purpose, may ferment and turn sour. But the glutinous matter that comes from the parts of animals long boiled, is first of all prejudicial by reason of its tenacity, and when corrupted offends by its grievous putrefaction. Common glue, when diluted with water, shall putrefy very speedily, and emit an horrible stink.

S E C T. XCI.

HAVING thus treated severally of the most simple diseases of the solids and fluids, it now follows, that we should treat of the most simple diseases that occur in both solids and fluids together.

We

We have now laid down the solid foundations upon which, though so very simple, depends the knowledge and cure of compound and oftentimes the most intricate diseases. After the most simple diseases of the solids, and the spontaneous degenerations of the liquids, our method, §. 16. leads us to proceed to such diseases, as are of a more compound nature. Since as long as life lasts, there is a motion of the liquids through the vessels; it is next to be enquired, what will be the effect, in case this motion be greater or less, than is naturally required to the preservation of health.

Of the DISEASES that arise solely from the EXCESS of the CIRCULATORY MOTION.

S E C T. XCII.

ALL the fluids, which are contained in any vessel, that has its rise from the great artery, are secreted from the blood only, which a little before was mixed together in the right and left ventricles of the heart, and appeared in the shape of one uniform liquid.

This is the first disease in which the solids and fluids are considered together, and in this chapter we treat only of the increased velocity of the motion of the fluids through the vessels; it is necessary therefore in the first place, to enquire into the nature and properties of the liquid that flows through the vessels.

All that liquid which flows into the right ventricle of the heart, and is expelled from the left, is termed blood. The heart receives the whole mass of blood by the veins from the whole body, and distributes it again
to

to every part by the arteries. From this blood the several parts of the body, with all the viscera, derive their humours, which are various according to their various structure. All the liquids of the body therefore are contained in the blood, though not in the form their distinct nature requires, but as to the matter, out of which is framed in every part, according to its peculiar fabrick, that which the adorable Creator had expressed in his infinite idea. When this is done, this matter, thus changed in the several different parts and viscera, returns to the heart, except a certain portion of it, which is excreted and thrown out of the body. And this matter is called blood, both when it passes from the heart and when it returns to it again. And this course is constantly continued, so long as life remains.

So that it may justly be said, that all the several humours are drawn from the blood, and all the humours contained in it.

This blood, consisting of so many different parts intimately united together, appears to be an homogeneous red liquid; and yet when left to itself will separate into distinct parts.

S E C T. XCIII.

YET it has even there, and then, larger globules of a determinate size, of a changeable figure, and of a red colour: and globules that are yellow, serous, and six times less than the red; as also a transparent liquor that coagulates when exposed to the fire; and a lighter thinner transparent water, consisting of still lesser parts, though not discernible by reason of their transparency. The mass of the former sort is called the red blood, of the latter the serum. Microscopes shew us both.

Sect. 94. of the Circulatory MOTION. 255

These particulars all depend upon the observation of Leeuwenhoeck ; for the human blood inspected through microscopes appears to consist of a great many spherical parts, swimming in a finer pellucid liquid, which by reason of its transparency eludes the sight. When the motion of the blood is viewed through a microscope in the transparent part of animals, it is plainly seen, that the larger particles of the blood are changing their figure every moment, when they are pressed through the narrow passages of the vessel, and meet with others, and consequently that they are flexible. These larger particles, according to the opinion of Leeuwenhoeck, are red globules, consisting of six smaller ones pressed together ; which smaller ones thus constituting a red globule by their union, would if separated look yellow and be globules of ferum. If the same analogy holds farther, these serous globules should consist of six lesser ones, and this division proceed even to the finest liquids that are secreted from the blood : but here our experience fails us, for whatever in the blood is more subtle than the red and serous parts is transparent. And yet as there is a most numerous series of decreasing vessels from the aorta (which is the largest vessel in the body) to the finest nerve, it is highly probable, that the humours which flow through each distinct series are proportional to them. A congeries of the largest particles of the blood has the name of red blood ; and all the other finer parts taken together constitute what is called the serum : for the blood when drawn out of the vessels, spontaneously separates itself into these two very distinct parts.

S E C T. XCIV.

THE red concreted mass, if divided from the serum, and kept apart by itself, will soon, by the meer rest and relaxation of its parts,

256 DISEASES from the excess Sect. 95.
parts, resolve in such manner into serum, that
very little of the red part shall be left remaining.

Let the vein of an healthy man be opened, and the blood that flows out will in a few minutes form itself into one red mass; by degrees this red mass shall contract; the thinner part separating more and more every moment, and having for the most part the red concreted substance swimming within it; pour off this serum, and after some few hours the red substance shall lessen, and a new quantity of serum be seen, 'till at last almost the whole of the red part shall be turned into serum. This should be, according to Leeuwenhoeck's opinion, because the red globules, consisting of six lesser ones, being now freed from the pressure of the vessels, by degrees separate into the ferous globules, of which they were formed. Whence we see, how extremely difficult it is to fix the proportion there is between the red and ferous parts of the blood, as the red part will by degrees be liquified into serum.

S E C T. XCV.

THE serum being long kept in an air moderately moist and warm, by the meer rest and relaxation of its parts, will resolve into a more thin, transparent, and light liquid, which by degrees will putrefy, and in great measure fly off in vapour. And these effects will be more or less in proportion to the time.

As the red part of the blood turns to a thinner serum, so will the serum, if left to itself, grow thinner, putrefy, and exhale, leaving only a few dregs behind. And as by being exposed to a moderately moist and warm air, the serum shall thus grow thinner, so will it also become more acrid, and will not coagulate
any

Sect. 96. of the Circulatory MOTION. 257

any more with boiling water or alcohol. The same particulars may also be observed in the white of an egg, for scarce any two liquids are found so much alike, as the serum of the blood and the white of an egg.

S E C T. XCVI.

ALL fresh blood (92), if exposed to a gentle heat, scarce exceeding the warmth of a man in health, and with little loss by exhalation. will run together into a solid, scissile, tenacious mass, indissoluble by water, oil, or spirit. And the same effect will follow, though the heat be communicated to it by moist bodies, through a singular kind of concretion resembling the former.

The blood of an healthful person is very prone to concretion ; the blood, which drops from a little ruptured artery in the nostril, presently runs together into a solid cake. But this proneness increases very much if the heat be increased ; for augment it but to the tenth or twelfth degree of the Fahrenheitian thermometer above the natural heat of a man, and it will all run into a solid mass. For which reason it is, that in acute diseases there is so much danger from the increase of heat. When the blood is thus coagulated, it is very difficult to resolve it ; many things mixed with it may prevent it from being thus easily concreted ; but when once the concretion is formed, neither salts, nor spirits, nor oils, nor even soapy substances, will be of much signification in our endeavours to resolve it. The blood thus inspissated by heat will liquify again by degrees in the open air, but then it will putrefy at the same time. Nor does this concretion seem to proceed from the dissipation of its most subtle parts by heat, for if it be received from the vein in hot water it will immediately coagulate. The

258 DISEASES from the excess Sect. 97.
white of an egg, in like manner, presently grows hard
in boiling water, though its shell be unbroken.

S E C T. XCVII.

THE redness of the blood (93, 94), and the disposition to coagulate in the serum and lymph (95, 96), is owing to the action of the vessels, and the power of circulation; as we learn from the changes made in the nature of the chyle, milk, and blood, and microscopes farther confirm to us.

It has been much disputed, from whence the blood should derive the wonderful properties abovementioned; and upon this occasion many strange suppositions have been advanced by philosophers, and many idle notions by the chemists; while none of them were ever able by any essays of their art to form the least drop of blood from the most nourishing food, it being the singular property of the human body alone, to produce the blood which it stands in need of out of matter, that is not blood. Nor does it signify whether a body be very small, and almost in the first rudiments of its existence, or already in an adult and firm state; so inseparable is actual existence of blood from human nature, that it is found in the weakest infant as well as in the strongest man; nay, there is even red blood to be seen in the human embryo, as soon as the embryo itself is capable of being discerned, and at the time, when there is not the least appearance of it in the placenta, the membranes of the *ovum*, or the liquid contained within the said membranes. So that we see the human body is capable of sanguification even from the beginning, though in so tender and mucous a state.

The time when the red blood is first produced in an human foetus is not easily to be determined by experiments;

periments ; but the immortal Malpighi has shewn it in a common egg. The fecundated egg of an hen before incubation shews not the least appearance of any red blood, either in its shell, membranes, white, treadles, yelk, or in the *sacculus colliquamenti*, though inspected through the best microscope.

But after incubation there was seen a change within almost every hour ; and first round the specks, near the yelk, were certain vessels plainly discernible, which within a few hours were easily distinguished from the contained liquid : in about thirty hours these vessels were of a colour somewhat greenish ; in forty hours they were of a rusty colour, (what they call xerampeline, from the resemblance it bears to the colour of a withered vine-leaf in autumn ;) at the same time it was seen, that the congeries of vessels that appeared in a cluster before were collected into one, which tending toward the speck ended in a sinus, which then first became visible ; which sinus, as afterwards appeared, proved to be the right auricle of the heart ; in this sinus, which hung down from the speck, there was plainly to be discerned a manifest pulsation, and soon after a small red point in the little pulsating body. After this the same redness appeared in the right ventricle of the heart, in the left ventricle, and soon after in a canal that ran lengthways along the speck, which was the aorta. Whence we know, that red blood may be formed out of a substance which is not red, and even without the intermixture of any red blood before existing. Farther, the red blood has first its rise in the little pulsating point, for it is first seen there, where the pulsation is, and is already red blood, before there is any redness seen in the rudiments of the chicken's liver ; which absolutely overturns the opinion of the Antients, who assign the office of sanguification to the liver.

Perhaps too the air, without which no plant or animal can live, has a share in this operation. For Mal-

pighi (a) has observed, that after forty-eight hours incubation the treddle ascends towards the obtuse end of the egg, where the air is lodged. And the chyle in adult persons, before it is changed into blood, flows through the lungs, where it is largely exposed in very tender vessels almost to the naked air itself. So in the opinion of the old alchemists, the air contained the hidden food of life.

In adult persons likewise the blood is formed out of the aliments in a resembling manner; for the lacteal vessels draw in the chyle prepared in the intestines as the vessels of the yelk do the *albumen* after it is attenuated by the heat of incubation; all the chyle meets in the thoracic duct; as in the young chicken all the vessels meet in one within the amnion. Red blood is generated in the chicken by the heat of incubation, the motion of the humours through the vessels, the power of the heart, and the action of the air in forty-eight hours; in an adult person human blood is formed from chyle in twenty-four hours, as appears by the observations of Lower and Walæus; and to this transmutation in an adult person the heat of the body, the action of the vessels and the heart, and the power of the air in the lungs, applied to the chyle while it is flowing with the blood, all contribute; and that this is sooner performed in a person grown up than in a young chicken, seems owing to the much stronger action of the vessels on their liquids, to respiration, and the quantity of red blood that was in the body before.

In cases where these causes are deficient, or act too slowly, what is produced is not red blood, but a degenerate liquor; as we have seen in girls that have the green-sickness: for the blood, that is made in them is not red, but a kind of greenish colour spreads itself over the whole body like that in the vessels of the yelk before the red blood was formed.

From

(a) See for all this his tract *de ovo incubato*.

From hence we see, that the blood does not propagate itself by any feminal virtue, as some have imagined, but is formed out of a matter that before was not sanguineous, and in a body which before had no blood in it; and as this was the case in the first dawns of life, it continues the same unto the end.

While in a grown person the blood is forming from the chyle, it is observed to undergo various and successive degrees of alteration: for presently after eating, the chyle is found to run pure and unmixed with the blood in the veins, for which reason in the blood that is taken away after a large meal, besides the serum and red part, there has been discovered a sweet white chylous substance fluctuating in it.

After some hours the chyle circulating with the blood is separated from it by the breasts, and produces milk of a different nature both from the blood and chyle: for it begins here to assume that concrement quality which is discernible in the serum, as it will yield cheese, which the chyle never will; and thus we may by art come up to a resemblance of chyle in emulsions, but never of milk.

If an healthy woman shall abstain from all food for twelve hours, her milk will begin to be salt and yellowish: if longer, there will be nothing found in the blood but what will coagulate, when exposed to the fire, like the white of an egg, which milk or chyle never does.

Whence we may reasonably conclude, that the body of a sound man is the sole fabricator of its own blood, even as every plant forms its own juice by its own peculiar make, out of the juices of the fertile earth and the surrounding air.

The principal cause in the formation of the blood seems to consist in the power of circulation, by which the vessels act on their contained fluids: for which reason the blood of very strong men is extremely red, so deep as to be almost black, and presently coagulates the moment it is at rest: so when the circulation

is increased in acute diseases, every part is red, and even the serum turns to a scissile mass : but in weak people, where the circulation is less, every part is languid and pale, and the blood hardly will coagulate at all ; but when even in these the force of the circulation is increased by exercise and proper remedies, the redness shall return, and a due cohesion be restored to the blood.

S E C T. XCVIII.

THE increase of the motion of the blood through the vessels, arises from the quicker and stronger contraction of the heart.

The nature of the blood being understood, the cause of its motion is next to be enquired into. This has been thought by many eminent men to have lain in the blood itself ; for when they saw the mixing of two liquors together would excite very violent motions, they thought something like this might take place in the blood. But if you receive the blood, as it springs from an artery bursting in the nostril in the most violent fever, in a very clean vessel, even though the vessel were warm, this blood will immediately be still, and not shew the least sign of any intestine motion ; and therefore the cause of its motion is not in itself.

But the heart by its muscular action throws the blood contained in its cavities with a very strong force into the arteries, and these, when the action of the heart ceases, the next moment press it forwards by their elasticity and muscular force : and these are the true and only causes of the motion of the blood, which has its first rise in the heart ; for the arteries, when contracted to the last degree, would naturally rest, if not dilated again by the blood that is thrown out of the heart. The muscular action of the heart therefore gives motion to the blood ; and when this ceases, an universal stagnation ensues.

If then the action of the heart, *i. e.* its contraction, (for in its diastole it acts not but is acted on), be more frequent and more strong, the cause of the blood's motion will be increased; for it is not enough, that it contracts more frequently, (since at the approach of death, the contractions are so quick as not to be counted, at which time the circulation begins to fail, because scarce any thing is thrown out of the heart), but it must also contract more strongly, so as to throw out whatever is contained within its cavities: for that is a strong contraction of the heart, which leaves the cavities empty, the weakest of all that which throws nothing out of them, and the intermediate degrees are the gradually weaker contractions.

S E C T. XCIX.

THE heart contracts oftener and stronger:
 1. By the action of the cerebrum and cerebellum, when expressing too large a quantity of the nervous liquid, as in the affections of the mind, and in pain: 2. Through the irritation of the heart by the accelerated motion of the venal blood, driven forward by friction, or the action of the muscles; or by some acrid matter mixing itself with the blood, whether of an aromatick, saline, acid, alkaline, purulent, ichorose, or putrid nature, and sometimes by a species of contagion of a pestilential or poisonous kind, which sort of evil has not hitherto been sufficiently explained.

In this paragraph are considered the causes, which are found by observation to excite and increase the motion of the heart.

1. The heart has all the properties of a true muscle, and is furnished with every part, which in other muscles is inservient to motion. When the nerve is

destroyed that leads to a muscle, the action of that muscle is destroyed: when the brain is compressed by the effusion of any humour, the action of all the voluntary muscles ceases: if there be a greater influx of spirits than ordinary through the nerves to any particular muscle, from whatever cause it proceeds, the action of that muscle shall be increased even to a violent spasm. The heart abounds with large and numerous veins, and yet no acute sense is raised in the heart by means of these nerves: the other muscles of the body are wearied and pained by too much motion; but in acute fevers the heart is moved with great celerity for many days without the least sense of pain: so that these nerves seem to be subservient to the motion of the heart. Now whatever can produce quicker motion of the spirits through the nerves of the heart, will increase the motion of the heart.

But this is wrought in a more especial manner by the affections of the mind. All men are sensible of this truth, but no one has yet explained by what means it is performed. Offer an affront to a man who is now quite calm and undisturbed, and on a sudden, by a change in his thoughts, an universal change shall arise in the whole system; his heart beats quicker and stronger, his pulse rises higher and fuller, he grows hotter, his face swells, his eyes sparkle, and even a violent fever will sometimes follow, that shall end in death.

Pain will also so change the whole brain as to cause a delirium, and so take away the sense of pain, or even a perfect syncope; which is the utmost that the sharpest torments can effect. As therefore pain can so affect the common sensorium, well may it affect the nerves which proceed from thence. Pain seldom continues long, but it causes a fever, (*i. e.* a quicker contraction of the heart), and even in such diseases as are most remote from a fever, such as the gout. So that Galen has well observed (*a*), *Dolor dum parvus est,*

(*a*) Gal. de pulsibus ad tyrones, cap. XII. Chart. Tom. VIII. p. 8.

est, atque initio, pulsum edit majorem, vehementiorem, celeriore, crebriorum; auctus verò jam & admodum validus, ut etiam vitale robur offendat, minorem, languidiorem, celeriore, crebriorem: “ When pain is
 “ little and in its beginning, it occasions the pulse to
 “ be higher, more vehement, swift, and frequent;
 “ but when it is increased and grown very great, so
 “ as to offend even the vital powers, it makes it less
 “ and more languid, but swift and frequent.”

2. By the irritation of the heart.] Besides the common causes of motion in other muscles, the heart has a singular property, that may be called its irritability; for when the influx of the spirits by the nerves into the *villi* of the heart, and the motion of the arterial blood through its substance, shall cease by death, its motion may be revived by wind or warm water blown through the veins; and even when cut off from all the vessels to which it adheres, it shall still preserve its motion for some considerable time; and though after this it lies quiet for many hours, if it be pricked with a needle and made moderately warm, it shall again begin to move. Physiologists have been very curious in their explications, why the heart should alternately become paralytic, and in an instant, almost as quick as lightning, be again convulsed with a kind of spasm; and how the cause, which produces the systole, should every moment cease, and be the next renewed; and this they have deduced from the structure and situation of the parts: and yet the heart, when taken out of the body, shall continue the same motion, though adhering no longer to any part, and this frequently too for a considerable time. See §. 1.

Of the venal blood.] When a young person falls into a syncope through passion, or the sight of any frightful object, the heart ceases to move; throw cold water on the naked body, and the parts contracted by cold shall propel the venal blood towards the heart and renew its motion. when the soul of Sarpedon wounded and fainting seemed disposed to leave him,

him, the breath of Boreas, contracting his veins by the coldness of the blast, recalled his spirit and restored him (b); whatever causes the venal blood to move more swiftly towards the heart, increases the motion of the heart; and thus a very high fever may be raised by too violent muscular motion, or by violent frictions, See §. 28. numb. 2.

Or by an acrid in the blood, &c.] Our humours in health are mild, (for the blood of a sound person dropt into the eye gives no pain) and the circulation is then most equable; but as soon as any thing acrid is mixed with the blood, the motion of the blood through the vessels is increased by the irritation of the heart, and a fever raised, which either expels the sharpness, or subdues it to such a degree, as to hinder it from doing any farther mischief: nor does it much signify what the acrimony is, as to the effect; acrimonious substances differ only in a greater or less degree and a more or less durable action. In spicy substances the acrid part included in a tenacious oil is so closely united, that it cannot easily be disjoined; and thus when a large dose of beaten pepper is unadvisedly taken to cure an intermitting fever, a mild tertian shall by this means be sometimes changed into a continual fever. If a man eat too great a quantity of salt at his dinner, he shall be feverish and thirsty in the afternoon, 'till by drinking freely he shall carry it off. Vinegar itself, which is of so much use in putrid fevers, if taken down in too large a quantity, shall raise a fever. If from an internal abscess purulent matter shall be collected, and this be again absorbed and mixed with the blood, it shall bring on an hectic fever every day, that shall by degrees prey upon the whole body; and if the pus by long retention shall turn to ichor, it will then become acrid, and being licked up by the vessels shall cause still greater mischief.

Corrupted

(b) Hom. Iliad. Lib. V. ver. 95.

Sect. 99. of the Circulatory MOTION. 267

Corrupted bile lying near the region of the stomach, or the putrid matter formed in a consumed liver, shall raise such enormous fevers as can never be cured, 'till the putrid cause be removed.

In all these cases the acrimony is visible to the sense; but there are other most surprising *stimuli*, which cannot be reduced to any known sort of acrimony, and yet disorder the whole system of the body in all its several functions.

The contagion of the small-pox seizes a man in perfect health with an infection, that eludes the senses: a very violent fever rises upon it, that in a few days overspreads the body both outwardly and inwardly with variolous pus; and in this pus, though formed by the disease from the soundest humours, there resides the same power of propagating the contagion *in infinitum*; as is plain from inoculation, which is performed by dropping a very small portion of the variolous matter into a fresh wound. Who now can be able to explain the nature of this stimulus? Or who will point out to us the manner how sound humours, changed by the variolous contagion, shall assume a poisonous nature, and at the same time acquire almost an infinite power of multiplying the poison?

Every sort of animals is liable to a particular plague, which seldom affects others. When the plague raged among the oxen throughout all Europe, the men were free from the contagion, and even those that eat of their infected flesh. The most eminent Physicians, who sought by diligent enquiry to find out the nature of this dreadful distemper, acknowledged, that all their skill was unable to penetrate into the causes of it, nor could they otherwise understand it, than by its effects. The pestilential poison, which lies inactive, though so closely adhering to wool, silk, linen, or to spongy and porous wood, when applied to the body of a man, becomes active, and multiplying the contagion spreads itself far and wide; and then how strangely it disorders the whole fabric, and what
violent

violent fevers are raised by it, &c. may be seen in Diemerbroeck and other writers upon the plague.

The surprising history of poison shews us, that there are such stimuli in the poisonous liquors of animals, as have no acrimony discernible by the senses, and which yet immediately disorder almost every function, and raise the most violent fevers. Of this the poison of the viper will serve for an example. Charas relying on the observations and honesty of the very noble Redi, tasted the yellow liquid that lies near the jaw of the viper, and found its taste to resemble that of the oil of sweet almonds (c) : whilst the smallest quantity of the same liquid, infused into a little wound made by the bite of the same animal in a gentleman carelessly handling it, within a few minutes brought on the most violent symptoms, insomuch that he hardly escaped with life, though all means were used cure him (d).

S E C T. C.

THE effects of the increased motion of the blood, are a more forcible action on the vessels that receive it ; a greater re-action of the vessels on the blood ; a strong compression of the blood ; a violent attrition of the vessels and blood against each other, and of the parts of the blood with themselves ; a greater heat of the whole ; an exsiccation of the blood by the dissipation of its watery parts ; its inflammatory viscosity and easy concretion ; the resolution of the blood into sharper salts and more volatile and acrid oils ; the enlarging the mouth of the vessels ; the forcing of the thicker liquids into the smallest vessels, their obstruction and destruction, inflammations, suppurations,

(c) Mosi Charas Oper. Tom. III. pag. 138.

(d) Ibid. pag. 156.

suppurations, gangrenes, sphacelus's and schirrus's ; together with the numberless consequences which may follow thereupon.

You have here the effects depending upon the increased motion of the blood, which have been observed both in the solid and fluid parts of the body.

A more forcible action on the vessels that receive it.] The arteries are always full, and consequently must be dilated when the heart throws out the blood contained within its cavities ; or at least so much must pass through the extremities of the arteries as is received by them from the heart : but all the arteries of the body (except the coronary arteries) are dilated in the very moment that the heart is contracted ; the action of the heart therefore is almost wholly spent upon dilating the arteries, by which means their sides are forced to recede from their axis, and all the fibres constituting the said sides are distended. And since an increased motion of the blood, as was proved §. 98. must arise from the more frequent and violent contraction of the heart, it is plain likewise, that the force, by which the sides of the arteries are compelled to recede from their axis, must be increased in a proportion compounded of the increased strength and frequency of the contractions of the heart.

Greater re-action of the vessels on the blood.] The arteries when they are distended are in a violent state, and hence their sides endeavour to approach nearer to their axis by their elasticity and muscular action ; and so repress the distending blood : for unless the arteries by being contracted through their own spring were to expel the blood which distends them, the heart would not be able the next systole to throw the blood contained in its cavities into the arteries that are already distended ; and consequently the blood would by degrees be accumulated within its cavities, and the circulation stopped. The stronger therefore the action of the heart is, which distends the arteries, the

greater will the power of that force be, by which the arteries endeavour to contract their cavities; and the oftener the heart is contracted in the same space of time, the more frequently will the contracted arteries re-act upon the blood that distends them.

Strong compression of the blood.] The blood in the arteries is as it were between two presses; when they are dilated, the impelling force of the heart drives the blood from the basis of the artery to the apex, in the mean while as the extremities of the arteries are very narrow, they cannot but make a very great resistance: when the arteries contract, the valves at their basis in the heart resist its return, whilst the same resistance also remains at their extremities as before; so that in both cases the blood in the arteries is compressed. But as the constituent parts of the blood are flexible and compressible, as we have already observed in §. 93. if the compressing causes, which are the actions of the heart and arteries, be increased, it will certainly follow, that the compression of the blood must of necessity be greater.

The violent attrition of the vessels and blood against each other, and of the parts of the blood with themselves.] When the blood is driven from the heart, and strikes against the sides of the incurvated aorta, this direction of the blood is resisted by the firm sides of the aorta, and the blood which is contained within its cavity; so that not a particle of blood thrown from the heart into the aorta will move in the same direction for two moments, that it had when it issued from the heart: add to this, that as the aorta is a cone which is broadest near the basis, and grows narrower as it lengthens, and the direction of the motion of the blood thrown from the heart is in lines perpendicular to its basis, particles of this blood must of necessity soon strike against the sides of this canal, and in their rebound meet with other particles in a contrary direction; from whence will of necessity arise a continual attrition of the particles of the blood both
with

with each other, and with the sides of the vessel; by which means, as the particles of the blood are flexible, their points will be broke off by this perpetual attrition, and they will acquire a spherical figure: and if this motion of the blood be increased, this attrition will be increased in like proportion.

Greater heat of the whole.] Heat arises from the attrition of the parts with each other, and the sides of the vessels. This is certain beyond all doubt, because as soon as the blood is at rest, all heat ceases, and the body returns by degrees to the coldness of the surrounding atmosphere. When the motion of the blood is increased by strong exercise or a fever, the heat increases too; but weak people, in whom the circulation is languid, are always cold.

It is a true saying therefore of Hippocrates, that *sanguis non est natura calidus, sed calefcit*; "blood is not hot by nature, but grows hot (e)."

The exsiccation of the blood by the dissipation of its watery particles.] Heat if increased will always disperse the most moveable parts. The whole body has exhaling vessels in every branch of its surface both outwardly and inwardly, by which the thinnest part of the blood is separated from the rest, and carried off. The more frequently therefore the blood is brought to these organs, the greater will the separation be. For which reason in all diseases, where the heat is increased, the body is dried. And therefore Hippocrates has observed (f): *quicunque vero ex febre ardente moriuntur, omnes ex siccitate pereunt*; "they who die of a burning fever die of dryness."

Its inflammatory viscosity.] The blood of the most healthful man is naturally inclined to coagulate as soon as it is out of the vessel. This quality is increased by greater heat, the loss of the watery parts, and the increase of the compressing powers. We have already shewn, that the watery part is carried off,

(e) In fine libelli de corde. Charter. Tom. IV. pag. 271.

(f) In fine libri primi de morbis. Charter. Tom. VII. pag. 549.

off, and the heat increased, by an increase of the blood's motion. But the action of the vessels upon the blood is a true compression of the blood they contain, and therefore as this action of the vessels is increased, when the blood moves with a quicker motion, it is plain, that in this all the causes concur, which are apt to make it coagulate. This produces the Phlegma Phlegmonodes of the Antients, so very different from a cold mucous concretion: it is now called likewise an inflammatory spissitude, arising from the violent compression of the elementary particles of the blood against each other. These elementary particles are observed to be spherical or nearly approaching to this figure, and for this reason they must have very few points of contact; but when their figure is changed by violent pressure, and the thin watery parts lying between are expressed, the elementary particles must then touch each other in a greater number of points and run into concretions; and hence arises that fizy stiffness resembling leather, which is seen in the blood of pleuritical persons.

The resolution of the blood into more volatile and acrid salts and oils.] The best specimen of the state of the salts and oils of the blood is in the urine, for that is the true lixivium of the blood, or the ablution of all the salts and oils that were growing too acrid, and would thereby do hurt. It is very clear, that the urine grows more acrid and fetid as the circulation is more violent: in weaker people it is pale, without smell, and not very salt to the taste; in strong persons accustomed to exercise it is more red and fetid, and very salt. If therefore the motion of the blood through the vessels be increased, it will make the salts of the blood to become more acrid and volatile, the oils also will grow thinner and be less mild: these again will form a fresh stimulus to increase the circulation, from the increase whereof they deduced their origin; and the effect of a disease will increase the disease itself.

The

Sect. 100. of the Circulatory MOTION. 273

The enlarging of the orifices of the vessels.] The force of the heart, which propels the blood into the arteries already full, is the only cause that dilates the arteries; as therefore this action of the heart increases, in like manner will that dilatation of the arteries be increased. But the dilatation will be greater, the nearer the artery is to the heart; and consequently the parts which lie nearest the mouths of the arteries will be the more dilated, as the force of this dilating power cannot possibly extend to the other extremities of the arteries with a like effect.

The forcing of the thicker liquids into the small vessels.] A red globule is found to be the largest particle of the blood, which naturally can be contained in the largest vessels only; the next particle to this in size is that which will enter a lesser vessel, that by reason of its smallness will not admit of a red globule, but gives a passage to every particle that is less. The same observation holds good in the other decreasing series of vessels; and health seems in a great measure to consist in this, that every vessel contains its own proportional liquid. But when by the increased motion of the blood, the entrances of the arteries of a decreasing series are enlarged, the grosser particles will thereby gain admittance into vessels, which naturally ought not to contain them. Thus when the entrance of an artery, (springing from an artery that carries red blood) through which there ought only to flow a serous liquid, is dilated, the red blood shall enter this serous artery. And this we have confirmed to us by the most certain observations. If a man in health runs violently, his face shall begin to swell, and grow red in such places as naturally are not apt to be red, the *tunica adnata* of the eyes shall have its vessels filled with red blood, whereas naturally these vessels have no red blood in them at all. After violent motion, or being hurried in a coach through rough ways, the venal tubes shall dilate, and give a passage to the

blood, from whence shall proceed bloody urine, which meer rest will easily cure.

[Their obstruction and destruction.] An artery grows gradually narrower in its course, 'till at length it becomes so small as to transmit only one particle of blood at a time. This appears to the eye in the transparent parts of living animals when viewed with a microscope, and more particularly in the lungs of a lizard, when drawn through an orifice made by incision; for in this case the microscope plainly shews, that at the narrow ends of the arteries, each little globe of the liquid passing through them is changed into an oblong cylindrick form, and so pressed through. When therefore a dilated serous artery shall in its entrance happen to admit a particle of red blood, this particle will not be able to pass through the narrowest end of it; in consequence whereof the pipe will be obstructed, and then by the continual motion of the liquids pressing against the obstructed part, the small vessel will be easily destroyed.

[Inflammations, &c.] When the red blood stagnating in the smaller vessels is compressed by the impetus of the blood lying behind, which likewise moves with the greater celerity, by reason of the fever that commonly attends it, it is called an inflammation; which therefore most frequently arises from the passage of the thicker liquids into the dilated lesser vessels. And when an inflammation is once formed, the several effects of it follow: for when the obstructed vessels, together with the unpassable humours impacted in them, are acted upon by the vital powers, 'till they are at length turned into a thick white uniform humour called pus, there is then formed a suppuration. But if all circulation of the vital humours, through the part affected, be cut off by the sudden breaking of the vessels, there follows a gangrene or death of the part; which mischief, if it extends to the corruption of every part quite down to the bone, is called a sphacelus.

Sect. 101. of the Circulatory MOTION. 275

sphacelus. But if the inflammation be near some glandular part, it often ends in a hard senseless tumour very difficult to be resolved, called a schirrhus.

If what has been said in this paragraph be duly considered, it will plainly appear, that numberless diseases may arise merely from the increase of the circulation. Every humour in the body may acquire a morbid nature by too much motion and heat, producing a greater pressure, a consumption of the watery part, coagulation, and acrimony. The solids are hereby subject to a greater attrition, and are frequently broken; and the dilated vessels become liable to receive such humours as are too gross to pass through them. And if at the same time it be considered, that this may happen both in all the parts of the body together, and in every distinct part of it separately, it will plainly be seen, that numberless diseases may arise from this simple cause.

S E C T. CI.

AN increased circulation therefore is known from its known causes (99), and effects (100); but especially by a quick and hard pulse, by a short and difficult respiration, and great heat.

It is of the greatest use in physick to know, whether the distemper be owing to too great a velocity in the circulation, or not. If the causes of the increased circulation, are to be seen, and there be any discernible effects of the violent motion, there is no room left to doubt of it; in the mean time there are some never-failing signs, which plainly point out an excess of the circulatory motion.

Quick and hard pulse.] The quickness of the pulse shews, that the heart is contracted more frequently than it should be in the same space of time; its hardness points out the fulness of the arteries, that the blood is very compact and dense, and that with diffi-

culty it gains a passage through the minute vessels by means of its inflammatory viscosity. The meer quickness of the pulse shews only that the heart is contracted more frequently, but not more strongly: for near death the pulse is quicker than ever, but at the same time very small. The hardness of the pulse without its being quick, denotes rather a stoppage of the circulation, as is the case of very plethorick persons.

Short and difficult respiration.] All the blood thrown out of the right ventricle of the heart ought to pass through the lungs before it can return into the left; but as the right ventricle would not suffice to propel all the blood through the narrow passages of the pulmonary artery by its own muscular force alone, there is farther required the concurring action of inspiration to dilate the lungs, and thereby open a free passage to the blood that is thrown from the heart. In proportion therefore as the right ventricle of the heart in a given time contracts oftener and stronger, so much the more frequent and more strong the inspiration is required to be. Thus we see, that whenever the motion of the blood is increased by running or any other exercise, the respiration increases in proportion, and is performed with greater difficulty. And thus the respiration is greater merely from an increase of the velocity of the blood, which passes through the lungs; but when besides this, through the greater motion the blood begins to assume an inflammatory spissitude, the respiration will then be much quicker and more difficult; for this ill quality in the blood, of its not being able to pass, first shews itself in the lungs; and for this reason, in acute inflammatory diseases, a short and difficult respiration is looked upon as so ill a symptom.

Great heat.] So long as there is a free course through the vessels, whilst the swiftness of the motion increases, there is also an increase of heat. But when the blood becomes so impermeable, as not to be able to reach to the extreme parts, these shall grow cold, whilst

Sect. 102, 103. of the Circulatory Motion. 277

whilst there remains a burning heat within ; as is the case in very bad continual fevers ; for which reason it is reckoned among the symptoms preceding death by Hippocrates, in his Prognosticks, and elsewhere.

S E C T. CII.

SUCH remedies therefore as are of efficacy in restraining too violent motion, will also be of service to lessen the too frequent and forcible contraction of the heart.

These simple diseases ought first to be considered apart by themselves ; here therefore is supposed no other change in the body, but an increase of the circulation only. The remedy therefore will be, whatever takes away the proximate cause of that increased motion ; *i. e.* the too quick and strong contraction of the heart ; *i. e.* whatever makes it move slower and weaker. Now such a remedy must act either on the spirits that move the heart, or on the arterial and venal blood, that more immediately belongs to the substance of the heart ; or, lastly, on those stimuli, which by their irritation cause the heart to be quicker and stronger.

S E C T. CIII.

OF which some relate to the mind, others to the body.

It has been observed §. 99. that a change of the thoughts only in the soundest body may so increase the motion of the heart, as to bring on a very violent fever ; and unless a Physician be able to remove this change in the thoughts, other means will be all ineffectual. And whatever does this without changing the body, acts on the mind. When a very angry

278 DISEASES from the excess Sect. 104.
man is put into a very great fright, his anger is asswaged by this change in his thoughts, though no alteration be wrought in his body. The other means that take away the corporeal causes of increased motion, act on the body only.

S E C T. CIV.

OF the former sort are such as will assuage any great passion by reasoning, by exciting a contrary passion or diverting it.

By reasoning.] We find in ourselves, that we think, and that the things we think of are different from our thoughts, and which, if they are objects, that merely employ the understanding, do but little affect us, and only hold us in contemplation: this we see in some considerable mathematicians, who thus spend their whole time in the exercise of their thoughts, and are little affected by any objects besides: we have farther another kind of perception, which we cannot easily communicate to others, though it be more clearly and strongly perceived by us, than even truth itself. Thus when we taste any pleasant wine, it raises in us an idea which we cannot explain, but only by saying, that we are pleased with it; and yet this pleasing sensation is as manifest, and as strongly affects us, as the most powerful truth can do. Let a man taste of a rotten egg, and it will raise in him such an abhorrence, that he will not be prevailed upon on any terms to taste it again. Thus the passions rising with their proper perception, hurry away the mind by an almost inevitable necessity to aim at the continuance of that which pleases, and the removal or destruction of that which displeases.

Now this pleasing or displeasing something which accompanies an idea, is distinct both from that idea and the thinking principles; and yet it disorders every
idea,

idea, and takes away, as it were, even the will and liberty itself, compelling us to desire or aversion ; for which cause these sensations have been called the affections or passions of the mind, and not without reason, as we are not their masters but their obsequious slaves ; since we very often see and approve the better part, yet unwillingly, as it were, take up with the worst.

When the pride of the philosophers endeavoured to annul that pleasure and pain accompanying the perception of our ideas, how greatly did they err ! The whole that the condition of humanity admits of is, that we govern our passions by reason : but this is often found too weak to break these strong ties. So that we are obliged to use our utmost endeavours in continuing the struggle, 'till reason grow stronger and triumph ; and, in truth, the wisest of mankind, with all the assistances of reason and religion, are scarce able to maintain their ground against the violence of their passions.

[Exciting the contrary affections.] The most prudent law-givers, as well knowing that human society is not to be supported by reason only, have therefore constituted rewards and punishments. The fear of punishment may restrain a man raging with anger, in a case where the wisest precepts of morality shall be of no force. It is therefore a circumstance of great advantage to know what affections are opposite to each other. Great fear suppresses anger ; and the most timorous man grows bold when angry. If the changes produced by these two passions in the body be observed, they will be found quite opposite.

In an angry man the heart immediately beats quicker and more forcibly ; the pulse is fuller, stronger, and swifter ; every part swells and grows broader, let the man be ever so lean ; a greater heat overspreads the whole body, almost every muscle is extended, the eyes start out of their sockets, and look fierce and sparkling, and charged with blood, and this fury farther vents itself in violent threatenings and reproaches, &c.

Homer, who in all cases has so well copied after nature, compares the eyes of Agamemnon, when angry, to a flame (a). When Achilles was angry, because his mistress was taken from him by force, his eyes shone terribly (b); and when Ajax persuades him to take arms again, he replies, "My heart swells with anger (c):" when he saw his arms brought him by Thetis, presently "his heart glows with rage, and flames of fire flashed from his eye-balls (d)."

On the contrary, a man struck with sudden terror, grows pale and cold, shrinks in every part of the body, his pulse is quick but low and unequal, the heart palpitates, the lungs are oppressed, and sobs and sighings follow; his strength fails him, his whole body trembles, or, as it sometimes happens, grows stiff like a statue, and his tongue cleaves to the roof of his mouth. For which reason Homer calls fear cold (e), and elsewhere speaks of pale fear (f); thus when Paris fled from Menelaus, "trembling seized his limbs, he fell backwards, and his cheeks turned pale (g);" and so in many other places.

Thus do contrary passions produce opposite effects in the body, and one affection of the mind may be a cure for another. The same might be shewn of the other opposite passions; but this one instance may suffice for an example.

Or by diverting it.] There is this wonderful property in our minds, that we can join the ideas we think of to certain arbitrary signs, between which signs and the ideas there is not the least similitude, and yet the sight of these signs shall present the idea to the mind. A few letters joined together shall raise an idea, which we have formerly had many years ago, and which we should never have recollected, had not these arbitrary signs preserved it for us.

And

(a) Iliad. Lib. I. pag. 7. (b) Id. pag. 11. (c) Il. Lib. IX. pag. 171. (d) Il. Lib. XIX. pag. 346. (e) Il. Lib. IX. pag. 149. (f) Il. Lib. XIV. pag. 272. (g) Il. Lib. III. pag. 50.

Sect 104. of the Circulatory MOTION. 281

And the case is the same with regard to the affections of the mind ; when Æneas was about to yield to the entreaties of Turnus, casting his eyes upon the belt of Pallas whom Turnus had slain (h).

————— *furiis accensus, & ira*
Terribilis : Tunc hinc spoliis indute meorum
Eripiere mihi ! Pallas te hoc vulnere, Pallas
Immolat, & pœnam scelerato ex sanguine sumit, &c.

When casting down a casual glance, he spy'd
 The golden belt that glitter'd on his side :
 The fatal spoils, which haughty Turnus tore
 From dying Pallas, and in triumph wore.
 Then rous'd anew to wrath he loudly cries,
 (Flames, while he spoke, came flashing from his eyes :)
 Traytor, dost thou, dost thou, to grace pretend,
 Clad, as thou art, in trophies of my friend ?
 To his sad soul a grateful off'ring go ;
 'Tis Pallas, Pallas, gives this deadly blow.
 He rais'd his arm aloft ; and at the word,
 Deep in his bosom drove the shining sword.
 The streaming blood distain'd his arms around,
 And the disdainful soul came rushing thro' the wound.

Whether it be an agreeable or disagreeable sensation that attends the recollection of an idea, the passions revive the more keenly, and thus may at length become perpetual ; then that power of thinking, which the mind before could extend to infinite objects, all perishes, and is wholly converted into this single passion, and the will, whose power was infinite before, now wills but one thing only ; this is called a delirium ; or if it be attended with an excessive violence, it is termed raving ; if with a fever and agitation of the humours, it is named a phrensy ; if it be without any of these, a mania, if at the same time there be a total neglect of all things whatsoever, it is called folly or idiocy.

For

(b) Virgil, Æneid. Lib. XII, at the end.

For this reason a prudent Physician endeavours, unknown to his patient, to remove all those objects, which may revive that idea, either by sensation or recollection: and sets before him whatever may excite a different idea, in order by degrees to diminish or destroy the former too violent impression; and this is called to divert the thought. And it is enough for this purpose, if by any means the thought can be so changed, that the same idea may not by its long possession occupy the whole mind, and at length become indelible.

But in case that violent passions shall disorder the whole frame, and irritate every branch of the nervous system, as often happens in hysterick persons, we then are forced to have recourse to such medicines as shall calm the spirits, and silence the action of the brain entirely for a season. Such a remedy we have in the juice of the poppy, which though taken in a small dose, shall bring on the most agreeable sensation that can be, and like Helena's Nephenthe, make us forget all our sorrows; in a larger dose, it causes sleep, and if given in too great a quantity will at last occasion an apoplexy. So wine, to a man not much accustomed to drink it, will produce a resembling effect; it will first make him chearful, then calm and composed, and at last lay him to sleep, and give him the rest he desires from all his troubles.

S E C T. CV.

THE latter act by giving rest to the muscles, relaxing the veins, (54), making milder whatever is acrid, either by diluting or blunting (66, 67, 68), and by taking away the causes of pain.

The remedies prescribed in the last paragraph were designed to restrain those impetuous motions, which were

Sect. 105. of the Circulatory MOTION. 283

were the effects of a change in thought, by acting on the mind rather than the body : what follows will take away the corporeal causes of an increased motion.

By giving rest to the muscles.] The influx of the venal blood into the cavities of the heart was reckoned §. 25. numb. 2. and §. 28. numb. 2. among the causes of the motion of the heart ; now the motion of the venal blood is accelerated by the motion of the muscles ; for most of the veins on the surface of the body lying on the muscles, are compressed by them when they are in action, and the blood is thereby thrown forward toward the heart, as the direction of the motion of the blood that flows in the veins is from the apex to the basis. Besides, when the muscles are in action, they look pale, the blood being expressed, and of course returns more speedily by the veins to the heart ; and thus it is, that the motion of the blood is so much increased by muscular motion. This is well known to the surgeons, who when the blood flows too slowly from a vein which they have opened in the arm, direct the patient to move his fingers, and presently it flows faster. And hence the Physicians of old, though unacquainted with the circulation, in all diseases, wherein there was too much motion, enjoined the most absolute rest, removed every object that might affect the senses, and kept their patients in darkness, at a distance from all noise and disturbance.

Relaxing the veins.] It is always observed, that in the most acute diseases, where the circulation is quickest, the greatest quantity of the blood lies in the arteries, and the veins are empty : on the contrary in languid diseases, where the circulation fails, the veins and all the cavities of the body are full, and the arteries empty : the relaxation and fullness of the veins therefore accompany a diminished circulation. But besides, when the veins are relaxed, as they are capable of being distended by the blood issuing from the arteries, they will contain a greater quantity of blood,
and

284 DISEASES from the excess, &c. Sect. 105.
and consequently a lesser quantity of blood is returned to the heart ; one of the chief causes therefore of its motion is of course diminished : at the same time the impetus of the blood flowing from the arteries to the veins is retarded, because of the greater mass to be moved which it meets with in the veins ; and on both accounts the velocity of the circulation must be diminished.

But we have already pointed out the method, §. 54. how the veins may be relaxed ; the best means of all is a vapour-bath applied externally to the surface of the body : and at the same time doing the same thing internally by the administration of clysters, giving to drink emollient decoctions, and prescribing a resembling diet. This was the method which Hippocrates constantly pursued in his treatment of acute diseases.

By making milder whatever is acrid.] Every thing known to be acrid, to what class soever it belongs, is capable of being cured by art, provided the viscera be yet sound. An acid, alkaline, or aromack acrimony is easily corrected ; but when those surprising poisonous stimuli, those contagious taints, that are not to be discovered by sense, and are only known by their effects, are the causes of producing an increased motion, art ceases to be successful. A girl bit by that most venomous serpent, called from the rattle in its tail the rattle-snake, soon died, and though a Physician was present, he was not able to give her any assistance ; and within a few hours after, when she was going to be dissected, the flesh fell off from her bones in a putrid state (a). When the most healthy man is infected with the contagion of the small-pox, which is so subtle as to escape all notice of the senses, the whole frame is thrown into disorder, and a violent fever ensues, which changes all the humours so strangely, that in fourteen days time the body both within and without is overspread with a gangrenous corruption.

(a) Journal des observat. physiq. mathemat. & botaniqu. par le R. P. Louis Fouillée, Tom. I. pag. 417.

Sect. 106. DISEASES from a defect, &c. 285
corruption. If this stimulus could be destroyed at the first coming on of the disease, no mischief would afterwards follow. This is that divine part (τὸ θεῖον) in diseases that so often eludes the power of art, and is the reason why Physicians so often fail in their attempts to restrain an increased motion, when too great. All that art can do is to weaken life, which makes the poison active, (for poisons are not capable of producing any effect on a dead body) and then by pouring down large quantities of diluting drinks to wash them away; and at the same time to blunt their edges by giving plentifully whatever is most emollient.

[Taking away the causes of pain.] When a bone is disjoined, very violent pain ensues, and is followed by a fever, which is not to be cured but by replacing the bone, and so taking away the cause from whence the pain proceeded. The cure of pain will be treated of afterwards in a chapter set apart for this purpose.

Of the DISEASES arising from a defect of the CIRCULATION, and of a PLETHORA.

S E C T. CVI.

THE diseases arising from a defect of the circulation are very near the same with those that arise in the humours from spontaneous rest. Only it is to be remembered, that the admission of air hastens their spontaneous corruption, its exclusion retards it; and so the knowledge and cure of these is to be drawn from them (58 to 80). And from all these taken together, the nature, cause, effects, signs, and remedies of a plethora are to be understood,
if

286 DISEASES from a defect Sect. 106.
if due attention be given to the following particulars.

The liquids contained within us are either crude, and such as retain the nature of the food we take down, at least in part ; or by the action of the body they have already acquired those properties which belong to human fluids. If then we consider, what may happen to crude or assimilated liquids, in case the circulation be diminished, it will plainly appear, that the same changes will follow in great measure as would happen to them if they stood still and were left to themselves. If the blood stands still but for a few moments, it is separated into serum and a red coagulated mass ; something like this happens, when the circulation is much diminished, and thence arise those polypous concretions which are so often observed after chronical diseases. Now the crude substances we take down, are all changed into our nature by means of the circulation ; if therefore this be defective, they will the longer retain their own nature, and be more liable to be corrupted by a spontaneous change. But as this subject has been treated of in the foregoing chapter, there can be no occasion to resume it here.

One thing only is to be observed, that the free access of the air is apt to promote all the spontaneous corruptions of the humours. For there is no fermentation without air, and putrefaction comes on far more slowly when the air is excluded. Water stagnating in a swelled belly shall lie in a manner uncorrupted for many months, but shall presently putrefy if exposed to the air.

In the last months of pregnancy, when the blood very nearly stagnates in the greatly distended vessels of the womb, there is no corruption : but when the foetus is excluded, and the air has free access, the lochia emit a very fetid smell. After a violent contusion the extravasated blood, which stagnates under the unbroken skin, hardly ever putrefies ; but is by degrees

grees attenuated, and being resorbed vanishes away : but if extravasated blood be exposed to the open air, it shall presently putrefy. If the humours therefore stagnate or move slowly in the internal parts of the body, where the air has no free access, it shall not so soon degenerate into a state of putrefaction.

But as the quantity of the liquid to be moved retards the velocity of the circulation, therefore the consideration of this subject is subjoined to this chapter and its causes, nature, signs, and remedies, explained in the six following numbers.

1. A plethora is a greater quantity of good blood than is capable of undergoing those changes, which unavoidably happen in life, without causing diseases.

Too great a quantity of good blood is called a plethora, and consequently of itself is never a disease ; for we here suppose the humours increased to be good, and that all things else are well-conditioned. For this reason Helmont thought a plethora was undeservedly ranked in the class of diseases, as he judged, there could not be too great an abundance of what was good. But when we say, that a man is plethorick, we mean not that he is sick already, but that he is in such a state of plenitude, that if the quantity of humours in him be farther increased, or these humours be rarified by heat or any other cause, the functions are liable to be damaged. Thus a man that is plethorick may be in a state of health, but in the mean time is in the greatest danger of being otherwise. For by an increase of heat in the ambient air, the least fault of the non-naturals, a more violent passion than ordinary, &c. his perfect health is liable to be changed into the most dangerous disease ; and it is impossible to prevent such accidents from happening to the most healthful man. For which reason
Hippocrates

Hippocrates said (a), *Bene habita athletarum valetudo, si ad summum processerit, periculosa : non possunt enim in eodem statu permanere neque consistere : quum autem non consistant, nec in melius possint proficere, superest ut in deterius vergant. Ob hæc ergo bonum illum habitum haud cunctanter solvere confert, &c.* " That the most perfect health is dangerous ; for as it cannot abide in the same state, nor yet change for the better ; it must therefore incline to the worse. And therefore it was most adviseable to alter this state without delay, &c."

By a plethora therefore is not meant every increase of the humours, but only an increase of the quantity of good blood. For which reason Galen says (b), *Ubi æquabiliter inter se humores sunt adaucti, illud plenitudinem & plethoram nominant : ubi verò vel flava bile, vel nigra, vel pituita, vel serosis humoribus repletum corpus fuerit, talem affectum cacochymiam, non plethoram vocant ;* " When the humours are all equably increased, it is a fulness or plethora : but when the body abounds too much with yellow or black bile, or pituita, or serous humours, such a disposition is called a cacochymy, not a plethora."

This fulness, according to the distinctions of the Antients, relates either to the vessels or the powers (*πρὸς ἀγγεία* or *πρὸς τὴν δύναμιν*) when the vessels are so full as to be in danger of bursting, or when by means of their too great distension the functions were not duly discharged, this was simply called plenitude, or plethora, *ad vasa* ; but when the vessels were not too full in themselves, but yet contained more than the weakness of the vital powers could move, this they called plenitude, or plethora, *ad vires*. The former is always and properly a fulness, the latter is so relatively with respect to the powers only. Thus Galen says (c), *duas esse plenitudinis species, vel ad virium*
robur

(a) Aphor. 3. Sect. i.
Charter. Tom. X. pag. 300.
Tom. VII. pag. 326.

(b) Meth. Med. Lib. XII. cap. 6.
(c) De plenitud. cap. 3. Charter.

robur & facultates corporis illam sustentis ; vel ad suscipientem capacitatem : “ There are two sorts of plethoras, either with respect to the strength and powers of the body sustaining it, or as to its capacity of containing it :” and elsewhere, “ (d) *Quanto enim gravior sibi videtur homo, tantum & plenitudinem quod vires crevisse constat : ad eundem modum, quantum auctus fuerit tensionis sensus, tantum & alteram auctam plenitudinem esse novimus, quam à quibusdam κατὰ τὸ ἔγχυμα vocari diximus :* “ So much as a man seems to himself to be heavier or oppressed, so much is his fulness in respect of his powers ; and so much as the sense of tension seems to be increased, so much is the other fulness increased, which some call κατὰ τὸ ἔγχυμα.

However, in the common sense of the word, a plethora is a fulness as to the vessels ; and in this sense it is used in this chapter.

- β. This is generated by all those causes that produce a large quantity of good chyle and blood, and at the same time prevent their attenuation and consumption, or their being carried off by perspiration.

The solids are unavoidably worn by the actions of health, and the fluids constantly flying off ; which waste ought to be supplied by the aliment. If what is thus restored be equal to the loss, the equilibrium will be preserved, and this is the surest sign of perfect health ; as Sanctorius has by his experiments proved even to demonstration, that the body would then be in perfect health, if it daily returned after digestion to its accustomed weight. This restitution of what is lost, is wrought by good chyle and blood that is formed from it. If therefore a greater quantity of good

(d) De curandi ratione per venæ sectionem, cap. 6. Charter. Tom. X. pag. 434.

good chyle and blood be generated than is required to supply the waste, the superfluous part will by degrees be accumulated. And this will be very much increased, if the force of those actions be lessened, by which the liquids ought to be attenuated, consumed, and carried off. The chief causes of these two particulars are contained in the following number.

2. To which contribute a great contractile power in the viscera, whose office it is to form the chyle, as also in the heart and arteries; together with a more lax contexture of the veins and other vessels; mild food that is easily converted into chyle; much sleep; a sedate mind; rest of the muscles; and a habit of letting blood, whether natural or artificial.

A great contractile power of the viscera, &c.] If the viscera, whose office it is to change the aliment into chyle, be firm and strong, a large quantity of chyle is drawn from the food we take down. And if the heart and arteries be equally strong, this large quantity of chyle is converted into good blood; and as the veins are always naturally of a laxer nature, they will easily give way to the distending liquid, and admit this superfluous quantity, unless they are emptied by exercise and motion. For as it was demonstrated §. 105. the less motion there is in the vessels, the more the humours are aggregated in the veins; whereas the greater the motion is, the more the arteries are filled, and the veins emptied. When hard drinkers pour down such vast quantities of liquor, they would be suffocated, if the veins were not capable of giving way and receiving the superfluous part of it, and therefore it is that these people have their veins so much inflated. If then much chyle and blood be formed in the several viscera set apart for this purpose, and the laxity of the veins at the same time be proportionably

portionably greater, the quantity of good blood must of necessity be accumulated.

Mild food.] Whatever is acrid increases the circulatory motion, as has been observed already §. 99. numb. 2. and by this means lessens the quantity of liquids, as has been shewn §. 100. a mild soft diet therefore, such as grain well ripened, broth from flesh, the flesh of young animals, very smooth herbs, which yield a large quantity of smooth chyle, all favour the production of a plethora.

Much sleep.] How much this contributes to relax the fibres when too rigid, has been shewn §. 35. numb. 2. but the vessels when relaxed will more easily give way to the distending liquid, and consequently be filled with more. Besides in sleep the loss that was carried off by the actions of the senses and our voluntary motions is repaired, as when we are awake those things are consumed which were accumulated in sleep: and thus a man, who is tired with the labours of the day rises chearful after such a sleep, as is proportioned to his health. When therefore we sleep too long, a larger quantity is accumulated and less carried off, and hence arises a plethora. And hence we so often see bodies, that have been wasted by violent diseases so well restored by long sleep. Bears live all the winter without food, asleep.

A quiet mind.] How much tranquillity of mind conduces to preserve health is visible to all. But a plethora is the effect of the most perfect health. Violent passions and consuming cares feed upon the body too, as well as the mind. Hence Ovid (c) :

*Attenuant vigiles corpus miserabile curæ ;
Adducitque cutim macies, & in aëra succus
Corporis omnis abit ; vox tantum, atque ossa supersunt.*

Where pining wander'd the rejected fair,
'Till harrafs'd out, and worn away with care,

U 2

The

(c) Metamorph. Lib. III.

The sounding skeleton of blood bereft,
Besides her bones and voice had nothing left.

Galen in the cure of too much fatness among other remedies reckons cares of the mind (f), τῆς ψυχῆς φροντίδας.

Rest of the muscles.] Ever since the sentence, which God pronounced against man for the punishment of sin, that in the sweat of his face he should eat bread, bodily exercise has been found necessary for the preservation of health. When people of plentiful fortunes give themselves up to sloth and idleness, in return they fall into grievous diseases, and suffer the punishment due to their laziness. Hippocrates has observed (g), *Homo comedens sanus esse non potest, nisi etiam laboribus exerceatur. Cibi enim & labores adversas inter se potestates, mutuò tamen ad sanitatem conferentes, habent. Labores namque ea, quæ adfunt, consumere solent; cibi verò & potus vacuato replere*; “That he
“ that eats cannot be well unless he labours. For food
“ and labour by their opposite effects both contribute
“ to health. For labour is apt to consume what is
“ in the body; and food to supply what is wanting.” And in another place (h) he lays down an excellent rule of health, and glories in being the first that ever prescribed it; i. e. to consider, *utrum cibi labores, an verò cibos labores superent, an moderatè inter se habeant; quodcunque enim superetur, ex eo morbi contingunt, ex mutua verò inter se æqualitate sanitas adest*; “whether the food exceeds the exercise, or this the food;
“ or whether they be duly proportioned; for either
“ exceeding will cause diseases, and on their due equality health depends.”

To the maintaining of the equilibrium between the food and exercise, it is requisite that a like quantity be carried off with that which is taken down;

(f) Meth. Med. Lib. XIV. cap. 15. Charter. Tom. X. pag. 335.

(g) De victus ratione sanorum, Lib. I. cap. 2. Charter. Tom. VI. pag. 448.

(h) Id. Lib. III. cap. 3. Charter. Tom. VI. pag. 481.

down; for if the quantity of the food be the same, and the exercise less, a plethora will begin to arise. If horses are kept without exercise and well fed, they will soon grow fat; but if they be inured to violent exercise for a few days, all this increase will soon be carried off again.

An habit of losing blood, whether naturally or artificially.] It is certain from observation, that the oftener a man loses blood, provided he be not quite debilitated thereby, the sooner does he fill with blood again. Women evacuate their superfluous blood by a natural constitution every month; and in just the same term they fill again with fresh blood. Men used to frequent bleedings suffer the same inconveniencies at their accustomed times of bleeding, as women do by the retention of their menses, 'till at length they lose the proper strength of men, and become lax like women. Dodart (*i*) has observed, that sixteen ounces of blood taken away by venæsection, were repaired within five days in a man not weakened before. Thus does repeated bleeding dispose to a plethora, by the blood's being so soon renewed; and perhaps too by the body's being rendered less strong and more lax, and so more easily filled. I have seen a woman, that upon account of some violent affections of the mind, which frequently returned upon her, had been let blood sixty times and more, in the space of a year, during which time she grew very fat, and gained 150 pounds in weight within the space of a few months; and as the blood's increasing so fast brought on a necessity of bleeding again continually, at length, her body losing all its firmness, she fell into a dropsy. It is not therefore a commendable custom, which some people have fallen into by way of precaution, to bleed often in a year, though they are well; since it weakens the body and disposes it to fill more easily. Galen, though he frequently

U 3

advise

(i) Hist. de l'Academ. des Sciences, l'an. 1707. pag. 134.

advifes bleeding, and that in the boldeft manner even to fainting, and calls thofe who diflike fuch bleedings αἱμοφόβος (*k*), men that were afraid to fee their blood, yet he condemned this cuftom, faying (*l*); *Nam per annum venam ſæpius ſecare, haud expedire arbitror; quod unâ cum ſanguine vitalis excernatur ſpiritus. Atque ſi hic copioſius abſumatur, tota moles refrigeratur, & omnes naturales operationes deterius perficiuntur*; “ I reckon it not adviſeable to bleed often in a year, “ becauſe the vital ſpirit paſſes out with the blood; “ which if it is much waſted, the whole maſs is “ rendered cold, and all the natural operations worſe “ performed.”

5. All the effects of a plethora depend on rarefaction, and that is to be aſcribed to the greater velocity and the heat occaſioned thereby, or to other cauſes which are to be known only by obſervation: hence follow the dilatation of the arteries, as well ſanguiferous as lymphatic; a change of the ſecretions; the compreſſion of the ſanguiferous and lymphatic veins; a ſtoppage of the circulation; inflammation; rupture of the veſſels; ſuppuration; gangrene; death.

All the effects of a plethora depend on rarefaction.] When the veſſels are too full of good blood, health may continue for a time; but if by any cauſe it be rarefied, then the functions begin to be diſordered. The changes which then appear are called the effects of the plethora, though they do not depend upon a ſingle cauſe, and the plethora be only the pre-diſpoſing cauſe, whiſt the rarefaction is the exciting or occaſional cauſe. For from theſe two cauſes united,
to

(*k*) Meth. Med. Lib. IX. cap. 5. Charter. Tom. X. pag. 210.

(*l*) De hirudin. revulſ. the laſt chapter near the end. Charter. Tom. X. pag. 455.

to wit, the pre-disposing and exciting, arises the more immediate cause of the appearing symptoms; and as the exciting cause or rarefaction brings the plethora into action, which of itself, unless it were in a very great degree indeed, would not soon bring on any disorder, so on this account the effects of a plethora are in this sense said to depend on rarefaction.

And that is to be ascribed to greater velocity.] By an increased velocity we mean a greater quantity of blood flowing through the vessels in the same time: but this can never be without an increase of the attrition of the liquids and vessels, whence comes heat, and from heat rarefaction. All the causes that are known by observation to rarefy the blood, seem to do it more especially by increasing its celerity, and by the heat which proceeds from thence. Rarefaction alone is farther capable of producing a plethora. For if the blood be rendered twice as rare as it was, it is the same thing with respect to the vessels, as if there were really twice the quantity of blood contained in them. Rarefaction therefore coming upon a plethora, increases all the inconveniencies which can possibly arise from a plethora. Hence it appears, why all the medicines and diseases, that occasion heat by increasing the celerity of the blood and rarefying it, bring on also all the symptoms of a plethora. A pale young woman of a cold constitution is infected with the small-pox; presently there comes on a heat and redness, an inflammatory tension of the vessels, an excessive pain in the head, &c. not from any increase of the quantity of the blood, but from its rarefaction by the greater heat, which has arisen from its accelerated motion.

Hence follow a dilatation of the arteries.] When the blood is increased in quantity, or by being rarefied takes up a greater space, it will necessarily dilate the vessels wherein it is contained, and thus both arteries and veins will be alike distended. But the blood cannot so easily be propelled from the arteries into the

veins, when they are too much distended, and consequently there will be a greater resistance at the extremities of the arteries. The arteries therefore must of course be the more distended by the blood that is thrown into them from the heart. Farther, as the different proportion, which the secreting branches bear to the trunk from whence they rise, is reckoned by physiologists amongst the causes assigned for the secretion of so many various humours in different places from one and the same blood; it is plain, that as this proportion must be varied by the dilatation of the arteries, so may all the secretions by this means be made irregular too.

The compression of the veins, &c.] In most parts of the body there are veins which accompany the arteries; and having weaker coats they must be compressed by the arteries when they swell too much, as they lie so near them; but the veins when compressed propel the fluids they contain towards the heart; the heart drives it forward into the arteries, and the veins being compressed are less able to receive it: hence there necessarily follows a still greater dilatation of the arteries, 'till at length the blood is almost entirely accumulated in the arteries, whilst the veins are still more compressed and emptied.

The circulation stopped.] For thus the resistance that is made to the blood, which is driven from the left ventricle of the heart, is increased every moment; and consequently the pulmonary veins will not be able so easily to empty themselves into the left ventricle of the heart; the blood therefore will begin to be accumulated in the vessels of the lungs, the resistance to the right ventricle of the heart will be increased, and at last the circulation stopped. Thus we see men that are plethorick to the highest degree are very red, the smaller arteries being dilated and admitting the red blood, 'till at length they begin to grow livid, being almost suffocated; and unless the quantity be lessened by a discharge from the vessels, either naturally

naturally or artificially, and by this means the heat and rarefaction be diminished, they shall often die suddenly.

Inflammation.] Through the thicker humours entering the least vessels when thus dilated, and not being able to pass through their narrow extremities.

Rupture of the vessels.] Especially in those parts of the body where the vessels are tender; for this reason plethoric persons are so frequently carried off by apoplexies, an artery being burst in the brain; and for the same cause we see them so often subject to an hæmoptoe, the pulmonary vessels being broken by the distending blood.

Suppuration, gangrene.] These are the common effects of an inflammation not resolved.

Death.] Which seems to be, because the vessels are so extremely distended as to resist the evacuation of the heart, whereby the circulation is stopt; or because the greater vessels being too full, compress the smaller in the cerebrum, cerebellum, and nerves; or because the vessels break and effuse the humours necessary to life; or, lastly because the extravasated humours, which have issued from the broken vessels, destroy the actions of the viscera, whereon life depends.

“ It is therefore easily to be known when present; and its future effects as easily foreseen.

We know that there is a plethora, if the causes mentioned (β) and (γ), as apt to generate too large a quantity of good blood, have preceded; if there be a great redness over the whole body, and more especially in such parts where the vessels lie exposed and uncovered with the skin, as the corners of the eyes, the inside of the eye-lids, the *tunica adnata* of the eyes, the inside of the nose, mouth, fauces, lips: if there be great heat even in the extremities; if the veins are inflated, and at the same time the pulse be strong

strong and full ; if upon an increase of motion or heat in the weather, or upon drinking wine, or taking any thing that is heating, there is felt a soft full distending tumour in all the muscles of the body, with a kind of immobility, so that the hands can scarce be closed, and this be followed by dulness and drowsiness, and a distillation of a watery humour from the eyes. These are the symptoms which supply us with a perfect diagnostic of a plethora.

The prognosis contains all the future disorders mentioned already in the paragraph (♂) ; more especially that all the functions of the head will be irregularly discharged, because in the head all is full naturally ; and thus if the great vessels, which are filled with red blood, are distended, the less will necessarily be compressed, for the hard bone of the cranium will not give way : and thus may all the diseases of the brain, from a slight vertigo, to a mortal apoplexy, take their rise from a plethora.

- ζ. The cure is wrought by bleeding, exercise, watchings, a more acrid diet after evacuations, and dropping evacuations by degrees.

Bleeding.] Too much blood, we have observed, was the cause of the disease ; whatever therefore lessens the quantity of it will be found to be of service ; but the speediest way of lessening the quantity is by opening a vein, and therefore bleeding immediately relieves all the symptoms. Medicine never cures diseases better than when it imitates nature. Now we see both in health and diseases a plethora, whether arising from too great a quantity of the blood, or from too great a rarefaction, is happily removed by a salutary hæmorrhage, particularly at the nose. For this reason this evacuation is so often serviceable to young people, that are strong and healthy, at that time of life, when the vessels being grown firm give a greater
resistance

resistance to the distending liquids, and especially as the warm weather comes on in the spring. And upon the same account, in very violent fevers, relief has been so frequently obtained by a spontaneous bleeding at the nose. In process of time, art, in imitation of those salutary efforts of nature, directed the opening of a vein; if it appears by the proper signs that the arteries only were principally distended, and the veins in a collapsed state, from the stoppage of the blood in the arteries, by reason of its being too thick to pass through them into the veins, as is often the case in acute inflammatory diseases, they then ventured to open even the arteries; and because this could not be done frequently in the greater arteries without some danger, by cutting through many of the smaller kind, by scarification they in great measure answered the same end. For this cause scarifications have been so much used in Egypt where acute diseases have been very common, as you may find from Prosper Alpinus in his *Medicina Aegyptiorum*.

Some persons, and the followers of Helmont in particular, have condemned bleeding as a cruel and useless practice, upon a supposition, that the too great quantity of blood might more effectually be diminished by a total abstinence from all food, for as the quantity of humours daily carried off by insensible perspiration, and the other sensible excretions, amounts in weight to several pounds, and this weight is again restored by the substance which we eat and drink; it is plain, if the liquids were continually to be diminished by these natural evacuations, and no fresh supplies were furnished by food, the quantity of liquids would be more lessened by abstinence in four and twenty hours, then it could possibly be by the boldest bleeding; but the inconvenience of this method is, that by this means the thinner liquids are only carried off, whilst the red blood, that distends the larger vessels, is scarce diminished at all, though this be the circumstance that is principally wanting, and all the humours

humours are rendered sharper for want of fresh chyle to mix with the blood.

But though bleeding lessens the quantity, yet as it leaves the body more liable to fill again, and consequently more disposed to produce a fresh plethora, as has been observed already in the paragraph (γ), it is requisite so to strengthen it, that it may not be liable to accumulate good blood so easily : and this is to be done chiefly

By labour.] Which both carries off that which would be retained in a state of idleness, and gives such a firmness to the solids, that they do not easily yield to the filling liquids. You seldom see working people plethorick, who labour hard every day, though they eat most voraciously. However, we must not prescribe exercise 'till the vessels are first emptied by bleeding, for otherwise vessels so much distended would be apt to break.

Watchings.] Too much sleep was reckoned among the causes of a plethora (γ); watchings therefore will have an opposite effect.

By a more acrid diet after evacuations.] Soft meats that are easily digested by the viscera, whose office it is to prepare the chyle, supply a large quantity of chyle, by which means the quantity of blood is daily increased, unless the superfluous part be carried off by the more effectual motion of the humours. Thus nature provides the softest milk for infants, which is food already digested in the body of the mother, because the swift growth of that age requires a daily increase of humours ; but in the contrary case, as in the cure of a plethora, the harder meats, such as are difficult to digest, and the sharper stimulating aromatic fauces, are more serviceable ; as these make less chyle, and consequently, *cæteris paribus*, less blood ; and farther, as acrid substances by their stimulating quality occasion an increase of motion, and prevent the accumulation of humours. But before the quantity is lessened by evacuations, acrid food would endanger
a rup-

a rupture of the vessels, by increasing the motion in them, when they are already too full.

Omitting evacuations by degrees.] How much frequent bleeding contributes to a plethora, has been observed already at the letter (7) in this section: This evacuation therefore is to be left off; and yet not at once, because all sudden changes from one habit to the contrary extreme are absolutely wrong, and especially in this case. For by frequent bleeding the body acquires a habit of accumulating a greater quantity, which if not conquered will bring on all the effects of a plethora; the quantity therefore of these evacuations is to be lessened by degrees, and the distance of time between them increased; that thus they may be gradually left off without danger. And in so doing we imitate that salutary method which nature makes use of in women, at the time their menses begin to leave them: for they naturally decrease in quantity, by gentle degrees, and have longer intervals before they return, 'till at length they quite cease: whereas when they stop all at once, very bad consequences are apt to follow.

The

The most simple of the compound
DISEASES, an OBSTRUCTION and a
WOUND.

An OBSTRUCTION.

S E C T. CVII.

AN obstruction is a stoppage in a canal, denying a passage to the liquid, whether vital, sound, or morbid, that ought to pass through it, and arising from the bulk of the matter that is to pass being greater than the capacity of the vessel that is to transmit it.

Of all the compound diseases indeed, the most simple would be a wound, as it supposes only the cohesion of the solid parts to be separated : but as there can be no wound of any consequence without an effusion of the liquids contained in the vessels, which then follow their own nature, it becomes necessary to consider the spontaneous degenerations of the liquids first. Besides, when the canals are cut through, they at first let out the liquids that were in them ; and then closing more up, they let go a thinner liquid only ; and at length, being quite stopped, an obstruction follows, and the flux ceases, as will appear hereafter when we come to treat of a wound in general. And for this reason, according to the rule laid down §. 160. an obstruction is to be considered first, as it takes place in every wound.

An obstruction is the stopping up of a canal.] This is the most general idea of an obstruction, as supposing any hindrance whatever to the passage of the liquids through the canals. By a canal is here meant

meant principally every vessel through which a liquid is continually passing, as in the arteries and veins : for those canals, through which a liquid passes not constantly, but only at some certain times, are rather to be called emissaries ; though an obstruction may arise in these too, as often happens in the bilious ducts, the urethra, &c.

All the liquids of the body are either carried by a continual motion through the vessels, or being collected in larger receivers, reside there only for a certain time. An obstruction seems chiefly to take place in the vessels, and very seldom or ever in the larger receivers ; for a stone in the bladder, unless it be big enough to fill up the whole cavity, makes no obstruction 'till it comes into the urethra. Polypous concretions, though formed in the venal sinuses, or even in the cavities of the heart, make no obstruction, 'till they pass out of these receptacles into the canals.

Vital, sound.] After the general definition of an obstruction, it is next to be considered, how many kinds of liquids are hindered from passing through the obstructed canals. This may be even the vital liquid, which passing to the heart is thrown from thence through the lungs and the aorta, and again returns to the heart for the support of life ; but life may subsist for a considerable time, though perfect health be wanting, as this consists in the perfect integrity of all the functions, which requires also a free passage through all the canals : so that there may be a great many obstructions, which shall be detrimental to health, and yet life remain notwithstanding. Thus if a small calculous concretion, which is the first rudiment of a stone, be formed in one of the small urinary tubes of the kidneys, an obstruction will thence arise, which will hinder the passage of the sound liquid, that ought to pass through this tube, and yet no extraordinary impediment to the motion of the vital liquids will follow from this circumstance, though

though the action of that canal, which is requisite to perfect health, be by this means taken away.

Or morbid.] Morbid liquids are all such as are so far degenerated from the natural state of sound liquids, as to disorder the functions, nor does it matter whether this degeneration may have been the cause or the effect of this disease. Thus in a pleurisy an inflammatory spissitude of the blood, which is the pre-disposing cause of a future pleurisy, makes the blood morbid, or apt to disorder the functions. But in the small-pox, where all the blood is corrupted with a purulent taint, the morbid state of the humours is the effect of the disease, and did not exist before it was brought on by the disease. Now these morbid liquids are sometimes carried alone through the canals, and sometimes mixed with other liquids, which have not as yet declined from a state of sanity; an obstruction therefore may be formed in the canals, which shall also interrupt the passage of these morbid liquids; and this is very evident in several diseases, where the morbid humours are by the vital powers translated from one place to another, as in the tumours of the parotid glands and the purulent abscesses of the legs, which are so salutary in a pleurisy and peripneumony. And thus in a true gout, if nature be hindered from throwing out that part of the most subtle liquid, which is degenerated, upon the joints of the feet, what terrible mischiefs will ensue!

Arising from the bulk of the matter that is to pass, &c.] This gives us a just idea of the proximate cause of all obstructions. The compression of the vessels will be hereafter mentioned among the causes of obstruction; and yet if the liquid were still thin enough to pass through the vessel so compressed, there would not in this case be any obstruction formed; for an obstruction does not only imply a difficult passage, but the entire stopping up of the canal.

S E C T. CVIII.

WHICH arises from the narrowness of the vessel, from the bulk of the matter that is to pass through it, or from both these together.

These three particulars contain all the possible causes of an obstruction: for either the liquid that is to pass is grown thicker, while the capacity of the canal remains the same; or the canal is grown narrower, whilst the liquid remains as it was; or the narrowness of the canal and the thickness of the liquid are joined together. The causes of each of these particulars, or of both of them together, are now to be enquired into.

S E C T. CIX.

THE straitness of a vessel may arise either from an external compression, or its own proper contraction, or an increase of thickness in the membranes themselves that form it.

We have here assigned the several causes by which the canals may become more narrow, the liquid to be transmitted continuing in the same degree of tenuity as before.

By external compression.] This is called by the Greeks *σπασίς*. In our canals a section perpendicular to their axis is always a circle; which as it contains the largest area that can be contained within the same circumference, all external compression by changing the circular figure must of course diminish the capacity of the canal; or could the compressing force be conceived to act equally all around the circuit of the vessel; though in this case it would not alter the cir-

cular figure, it would lessen the diameter, and so render the cavity in like manner narrower.

By its own proper contraction.] In this case the vessel is said to be contracted by its own spring. For the sides of the vessels naturally approach nearer to their axis, as soon as ever the distending cause is lessened. This was necessary, that when the quantity of humours is diminished, the circulation might continue uninterrupted through the vessels, continuing still full indeed, but by contraction grown narrower. And this is the reason, that a great and sudden loss of blood, before the vessels have time to contract and so keep themselves full, by interrupting the circulation, shall cause a syncope, and sometimes death, in case the inanition be very sudden indeed. If therefore this contraction, which belongs to our vessels, be increased, or the force or quantity of liquids distending them be lessened, the same effect will follow, and the canals be rendered narrower.

Or by an increase of thickness in the membranes.] It is plain, that if the thickness of the membranes be increased, the cavity of the canals must be made narrower. To distinguish this cause of obstruction from the *σπασμός*, the Antients have termed it *συστολή*, or straitening of the passage, to denote that the cavity was made narrower by an increase of substance in the sides of the canal.

S E C T. CX.

THE bulk of the matter to be transmitted is increased by the viscosity of the fluid, or by its being admitted into a wrong vessel.

In this paragraph are considered the faults in the fluid, which may cause an obstruction, though the capacity of the canal remains the same.

The elementary particles, whereof our humours are composed, have a determinate magnitude proportional

tional to the narrowest extremity of the vessels through which they are to pass. Thus an elementary particle of red blood ought to be so small, as to pass through the narrowest extremity of the smallest red artery; and so in the other orders of the thinner liquids. If then by any cause whatever the elementary particles, whereof the liquids are composed, be increased in bulk, they will stop at the extremities of the arteries; because, as Leuwenhoeck's observations shew, the particles of red blood pass single through the extremities of the arteries, and that with some difficulty; should they then be expanded, so as to take up a greater space, whilst the quantity of the matter they contain remains the same, the freedom of their course would be interrupted; so that we may conceive this to be the cause of an obstruction, though perhaps it very rarely happens.

But there may be another fault in the liquids which perhaps is much more common. The particles of all fluids, as the natural philosophers have proved, cohere with a certain degree of force; which also obtains in our humours: but that the particles of these may pass through the extremities of our vessels, it is requisite, that they pass single and separated from their cohesion with the rest; the powers therefore that carry the humours through the vessels must be able to overcome this cohesion. Should therefore the cohesion of the elementary particles be so increased, as not to suffer themselves to be divided from each other by the action of the heart and vessels; several of them will remain united together in parcels, which ought to pass singly through the extremities of the vessels; by which means there will be formed an obstruction; this is called an increase of their viscosity, as we have not a more general term to express it by, though it denotes only that physical state, which renders a fluid less capable of passing through a canal, by reason of the too great cohesion of the elementary particles whereof it consists.

By its being admitted into a wrong vessel.] This is said to be the case, when good humours have entered into vessels where they naturally ought not to be, and through whose extremities they cannot pass. V. g. When red blood enters the serous or lymphatick arteries, by their being too much dilated in their first openings, this blood is said to be admitted into a wrong place: thus though the humours have all their proper qualities, and the vessels be all sound, yet if by being only dilated a little too much in their cavities, they admit of a grosser liquid, the most obstinate obstructions may be formed. And this indeed is the most frequent cause from whence obstructions in general do arise; for if the impetus of the circulating fluid be at all increased, the red blood shall presently enter into such vessels as do not belong to it. Thus if the eyes be rubbed ever so gently, there arises a redness in the *tunica adnata*, where naturally there is no red blood at all. Upon violent running the skin shall grow extremely red, from the red blood's being driven into the smaller vessels. For though, properly speaking, the bulk of the particles that constitute the fluids is not increased, yet with regard to the vessels, whereinto they are wrongfully admitted, it is their too great bulk which is the cause of the obstruction.

S E C T. CXI.

AND from both by a concurrence of the causes of both (109, 110).

For it is possible that the causes which straiten the canal, and those that render the liquid unpassable, may concur together.

Hence it appears to what simplicity this whole matter might be reduced, if the proximate cause only of all obstruction was to be considered. But the difficulty lies in this, that their remote causes are so many

ny and so various, which we are now going to enumerate.

S E C T. CXII.

THE vessels are compressed externally,

1. By a neighbouring tumour, either plethorick, inflammatory, purulent, schirrhous, cancerous, œdematous, ampullary, steatomatous, atheromatous, meliceratous, hydatidick, aneurismatick, varicous, pituitous, calculous, or callous.

1. A tumour.] Physicians and Chirurgeons have given the name of tumour to the increase either of a particular part, or of the whole body, when it rises above its natural magnitude, from what cause soever it may proceed. As therefore the part, which swells, takes up a greater space than it did before, it must necessarily make the vessels near it narrower by compressing them. Now these tumours must all arise, either from the fluids distending the vessels beyond their natural bulk, or from their being extravasated, or from the vessels being concreted with their inspissated liquids. Of these tumours the principal differences are such as have been here enumerated.

Plethorick.] Namely, when the arteries and veins, which are charged with red blood, are so distended by the quantity they contain as to compress the smaller vessels that lie near them. The effects of this kind of tumour are especially seen in the damage it does to the actions of the brain: for the cranium being always entirely full, and no red blood being any where to be found but in the *pia mater*, and the large red arteries dispersed through the medullary substance of the brain, and surrounding the *medulla oblongata*, the cortical substance naturally containing none, it follows, that when these red blood-vessels are distended,

as the hard boney part of the cranium cannot give way, the other vessels of the cortical substance and the medulla must be compressed, by which means all the functions of the brain will be disordered; only the cerebellum, being much firmer than the cerebrum, will in this case be the less affected.

Inflammatory.] When the vital power drives the vital liquid into an inflamed vessel, it must necessarily distend that vessel, because the liquid thus impelled cannot pass through an obstructed vessel; for which reason the whole imperus of the impelled liquid is employed in dilating the sides of the vessel, which lie immediately before the obstructed place, and of course the adjacent vessels will be compressed; so that the circulation will hereby be interrupted, not only in the inflamed vessels, but in the vessels also that lie near them: hence the tumour increases, and especially if the cellulous membrane be inflamed; in which case a tumour shall grow so big, that an inflamed finger shall at some times be ten times thicker than in a natural state.

Purulent.] Which is of two sorts, either from pus inclosed in its proper membranes, and forming a purulent imposthume; or when these are burst, and the pus is discharged into the vacuities that lie near it, both ways it must straiten the neighbouring vessels by its pressure; hence whenever there is a gathering in the subcutaneous parts, we generally find the vessels of the skin inflamed.

Schirrhous, cancerous.] This arises from a gland first swelled and then indurated; by which means the vessels dispersed through the proper membranes of the gland, as also in the parts that lie near it, are compressed, and therefore a large schirrhous is always attended with varicous veins. What dreadful mischiefs have arisen from a schirrhous tumour in the parotid glands, which by pressing upon the adjacent jugular veins has prevented the return of the blood from the head? If the axillary and inguinal glands become schirrhous,

schirrhous, by compressing the neighbouring veins, arteries and nerves, they will deprive the parts that lie under them of all vital humours, as may be seen from abundance of instances recorded by the writers of observations. But when the schirrhous by an increase of malignity degenerates into a cancer, as the tumour is then constantly increased, it proves always the more prejudicial.

[Œdematous.] Galen observes that the Antients called every swelling by the name of *Οἰδήμα*, *Antiqui & tumorem oedema appellabant* (a); and elsewhere, that preternatural humours were termed *οἰδήματα* by Hippocrates (b); but afterwards the later writers, he says, laid aside this use of the word, and called each tumour by a distinct name: if they were painful, they were called *phlegmones*; if without pain, or hard, *schirri*; if without pain and soft, they were then properly called *οἰδήματα*. But Hippocrates calls such soft indolent tumours no: simply *οἰδήματα*, but adds another word to distinguish them from other tumours. Thus in the Prognosticks and Coan Prenotions, they are called *οἰδήματα μαλακά, ἀνώδυνα, τῷ δακτύλῳ ὑπέκοντα*, soft indolent tumours, that yield to the pressure of the finger. This is the meaning of the word at present, which is applied only to tumours, that arise in the *membrana cellulosa*, the true seat of an œdematous swelling. The matter of them is generally water, as in the anasarca dropsy; or some more viscid pituitous liquid, as in a leucophlegmatia. Now a *membrana cellulosa*, which is the true seat of these tumours, surrounds all the vessels; and consequently the tumours arising thence are capable of making all the vessels narrower, and frequently of producing very surprizing diseases, which shall be entirely owing to this single cause.

[Ampullary.] Such ampullæ or follicles are very numerous in several parts of the body; the whole skin, the inside of the mouth, throat, stomach, and

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intestines

(a) Comment. IV. Aphor. 34. Charter, Tom. IX. pag. 115.

(b) Comment. V. Aphor. 65. Charter, Tom. IX. pag. 239.

intestines are thick set with them. In these a fat or mucilaginous humour, secreted from the arterial blood flows through its proper emissary, and serves to lubricate and anoint these parts. If then this emissary should chance to be obstructed, the quantity of it will be increased, and the follicle distended; and this to such a degree, that from a size too small to be discerned by the naked eye, it shall grow up to the weight of several pounds; those minute little receptacles in the hairy part of the head that supply the unctuous liniment, which feeds and lubricates the hair, grow sometimes to an immense bulk, and are called *moles* by the Chirurgeons. Many instances of the like tumours in other parts of the body are also to be found among the writers of observations.

This is the general idea of these ampullary tumours: but they differ very much, according to the nature of the matter they contain, and have thence received a very different name. If the matter resemble a mixture of flour and water, it is called an *atheroma*: if it is of a middle degree of fluidity between honey and wax, it is named a *meliceris*: if it is of a somewhat harder consistence, and looks like fat, it is termed *steatomatous*. But of these see §. 75. before.

Hydatidick.] Hydatides, as the word is now used, (for heretofore it signified an increase of the fat which lies under the outer part of the upper eye-lid^(c)), are little membranaceous bags of various size, which are often found in divers parts of the body, both external and internal, filled with a watery humour. But whether these are to be always considered as ampullary tumours, seems at present very doubtful; for these tumours, as we have already observed, are no other than the natural follicles dilated and swelled; but hydatides have been found in places where no follicles have ever been discovered by any anatomists; thus Ruysch found the uterine placenta entirely changed into

(c) Gorræi definit. Medic. pag. 656.

into hydatides (*d.*) Nay such hydatides have been even found fluctuating and unconnected either with any of the neighbouring parts, or with each other, and included in a large membranaceous bag: and which is still stranger, the large hydatides have contained lesser ones alike loose in their cavity (*e*): and farther, when the waters taken out of dropical persons that have died have been boiled, it has been found that the very substance of the follicles, which had appeared to be membranaceous, was dissolved (*f*). For which reason some great men have concluded, that the peilicles of these hydatides were not organical parts, but accidentally produced by the incrassation of the liquids. However there is nothing to hinder, but that the natural follicles may be expanded by a watery humour to an enormous size: such hydatides are often observed in the edges of the eye-lids, the sebaceous glands, which are seated here, possibly degenerating into this form. Ruysch found one of the ova in the ovarium of a woman thus expanded into a very large bulk, and full of liquid (*g*).

That such hydatidick tumours have been found in various parts of the body, appears plainly from the passages in the authors we have already cited, to which might be added abundance of other instances from Bonetus and other writers of observations.

Aneurismatick.] An aneurism, or rather aneurysm, ἀνὸ τῆ ἀνευρύσεως, denotes the preternatural dilatation of an arterery in any part, so that from an uniform conical figure which it had before, it shall be changed in the part that is weakened into a sinus, which by compressing the neighbouring parts shall be capable of producing terrible mischief. Thus the sagacious Albertinus (*b*) to his great surprize found the ribs, clavicles, and sternum, not only elevated, but broken, and

(*d*) Observat. Chirurg. p. 33. (*e*) Acta Petropolitana. Tom I. pag. 379—382. Acad. de sciences, l'an. 1722. Mem. p. 222.

(*f*) Acad. des sciences, l'an. 1719. Hist. pag 49. (*g*) Observat. Chirurg. 17. (*b*) Institut. Bononiens. pag. 383.

and the inside of the vertebræ of the back worn away quite down to the spinal marrow, and consumed by an aneurysm near the vital parts. Ruysch found the ribs quite carious, and even wasted, together with the sternum, by nothing but an aneurysm (*i*).

Varicous.] What an aneurysm is in the arteries, that a varix is in the veins, and a much more frequent disorder, as the veins yield to the distending blood more easily, and the blood moves slower in them than in the arteries; for which reason a small obstacle shall suffice to hinder the motion of the blood in the veins, by which they shall be distended and become varicous. This incident more particularly happens to women with child; because when the womb is distended and presses upon the iliack veins, it prevents the veins of the thighs and legs from discharging the blood they contain so expeditiously as they ought; for which reason they are subject to these varicous tumours, and especially in the legs.

Tophous.] In this disorder, the lamellæ, which constitute one of the larger bones, are by the disease removed from each other, elevated and formed into a tumour, not quite so hard as a bone indeed, but hard enough to be pared, and of a resembling degree of firmness with that of the horns of young animals at their first budding. Such tumours frequently occur in all the diseases, which are more particularly apt to affect the bones, as in the rickets, scurvy, and more especially in a confirmed pox; in which disease these tumours, by compressing the vessels of the periosteum, and distending the nerves, which have here a most exquisite sense, become extremely painful. To this head belongs an exostosis in which case the hard substance of the bone itself is elevated into a tumour, and compresses the vessels that lie near it.

Pituitous.] This arises from an accumulation of the natural or morbid gluten, which distends the cavities wherein

(i) Observat. Chirurg. 37, 38.

wherein it lies, and thereby presses the vessels that are adjacent to it.

Calculous.] Every one knows the terrible consequences arising from stones in the kidneys, ureters, and bladder, whilst they compress the parts they lie on by their size and weight.

Callous.] A callus is a membranaceous part increased in bulk, attended with hardness and insensibility, arising from the vessels being concreted together, and chiefly by an external compression. Its proximate cause is the compression of the vessels, the expression of the liquid they contain, and the concretion of their sides. In infants just born there is no callus seen, but afterwards when they begin to walk, and the whole weight of the body is sustained by the bottom of the feet, the vessels becoming flat they lose their liquids, and begin to grow together and form a callus. So the palms of the hands in smiths often grow as hard as horn by the attrition of the hammer. Now as a callus is destitute of all vital liquid, of itself it can do no greater mischief, but as by its size and hardness it oppresses the parts that lie underneath it, it may cause an inflammation, and bring on other very troublesome disorders. Thus it has been found, that an hard callus near the prominence of the metatarsal bone, that sustains the great toe, has almost entirely taken away the use of the foot; while the whole weight of the body pressed this hard callus against the inflamed and much pained parts that were placed under it. When the nervous papillæ in the skin, with the sanguineous and lymphatick vessels, &c. with which their extremities are covered, are pressed flat, a slight inflammation first follows, and afterward all turns as hard as horn, and then we call it *clavus* or corn; which is a very very common and no less troublesome disorder in the toes, and sometimes in the external part of the ear, when its cartilaginous folds are too much pressed by the coverings worn upon the head; or when a person is obliged to lie only on one
side,

side, from wounds, empyema, &c. and so continually pressing the ear against the pillow. These corns are true callus's, but very hard, and being broader outwardly, and by degrees converging inwardly as they descend under the skin, they derive their name of *clavi* from their figure; and as they adhere to the nervous parts which have a quick sense, they therefore cause such an excessive pain when pressed upon. The same kind of callus's may arise also from a compression in the inward parts. Upon opening the body of a young woman, I have seen the external coat of the spleen, which was much larger than usual, and had been pressed against the last of the ribs, both callous and thicker by far than it ought to have been, precisely in that place where it had been exposed to the pressure.

2. From the hard parts being broken, disjoined, distorted, distracted, and thereby compressing the flexible vessels.

We have here enumerated the several ways by which the vessels are straitened, from the external compression that arises from the removal of the hard parts of the body, such as the bones and cartilages, out of their natural position, and thereby pressing the adjacent vessels; the obstructions likewise in the vessels, which happen from the ligaments when they are distorted or distracted, fall here also under our consideration.

Broken.] When a bone is divided into large pieces, it is called a fracture, which can never happen, but the vessels which run between the lamellæ of the said bone must be compressed and even destroyed: for the same reason, the vessels of the periosteum must also be necessarily compressed; especially if the parts of the broken bone be removed out of their natural situation, in which case they cannot but

but compress all the parts that lie near it at the same time.

Disjointed.] When the head of an articulated bone falls out of the cavity it used to move in, it is called a luxation; but this cannot be without the compressing of the ligaments that surround the joint, as also all the adjacent vessels. Whilst the head of the *os humeri* in a luxation lies in the arm-pit, it compresses the great vessels there, and is attended with very bad consequences, arising chiefly from the compression of the great trunks of the nerves that are distributed through this part.

Distorted and distracted.] Distortion and distraction do not properly relate to the bones, but to the ligaments, by which they are connected. Distortion is a violence offered to the ligaments by the twisting of the bones, while yet they retain their position. Distraction is when they are pulled by any great force, as by the lifting up too great a weight, in which case the ligaments of the joints are stretched out to a greater length. It is plain that neither of these cases can ever happen, but many of the vessels passing along the ligaments must be compressed and made narrower.

3. By every cause that draws the vessels too much and lengthens them, whether it be a tumour, or the pressure of a part that is out of its due position, or some external force that strains them.

A flexible canal cannot be lengthened, but its cavity must be lengthened at the same time. This is plain to the eye, when glass tubes are lengthened at a lamp. An obstruction indeed will not immediately happen in the larger canals from their being made narrower by lengthening, but it will easily happen in those small canals that transmit only single elementary particles

particles of the fluids through their extremities. In torturing malefactors, the ligaments of the joints are strained by weights or pulleys, and the pain, inflammation, and redness which are discernible the next day, sufficiently testify the obstruction formed in the vessels by their elongation. All tumours lengthen the vessels of the parts where they are seated, by distending the membrane which surrounds them. The bones, muscles, tendons, when out of their natural situation, produce the same effect. To this article also belongs all external force, that acts by lengthening the part.

4. By external compression from strait garments, bandages, or by the weight of the whole body lying on one part while at rest, ligatures, &c. to this head also belong the motion, attrition, or squeezing of any part against other bodies.

In the former numbers, such causes of obstructions by straitening the vessels have been enumerated, as arise from the vessels being swelled or thrown out of their proper position, and by this means compressing the adjoining vessels; as also those causes, that by lengthening the vessels, lessen their capacity. Under this head come all those that render the vessels narrower, by pressing upon the external surface of the body.

[Strait garments.] These compress all the vessels that are situated on the surface of the body; especially the veins, as they are more easily to be compressed, and as they lie nearer the surface than the arteries; for the arteries are both stronger and more securely placed. Now by this compression of the veins, there is a greater quantity of blood thrown into the arteries; and of course the effects of a plethora are produced. If the vessels then be so weak as to break upon the least increase of the quantity or motion of the fluid contained in them, or if by being distended they

they discharge from their extremities into the cavities of the body the liquids which they naturally ought to retain, garments that are too strait may by this means be the cause of considerable mischief: especially in such persons as are liable to spitting of blood or making bloody urine. And from this cause it is, that hysterical women, hypochondriacal men, and asthmatick people, &c. in whom the least change of the ballance between the solids and fluids is apt to produce such enormous effects, are so much relieved by letting loose their garments, which before were wrapt too tight about them.

Bandages, ligatures.] These have different effects according to the degree of astringion. If but moderately tight they confirm the lax distended parts, and supply the defect of the fibres when too weak; if they be drawn closer, they will contract the vessels, and especially the veins; if closer still, they will render even the arteries narrower: whence inflammation frequently, and sometimes even a gangrene, may follow. When the surgeons in order to retain a fractured bone, which they have reduced, in its proper position, amongst other remedies have recourse to bandages; if they be drawn too tight, within a few hours a tumour shall first arise in the part affected, and be afterwards followed by inflammation and a considerable pain: if in this case the surgeon cruelly neglects to hearken to his patient's complaint, he will have cause to lament his mistake afterwards, when a gangrene follows upon it.

The incumbent weight, &c.] When sick people become so insensible as not to feel the slight uneasiness to which the body is subject, as often happens to be the case in acute diseases, or are obliged by reason of their severe pains, such as the gout, rheumatism, &c. to keep in the same posture, the whole weight of the body rests upon the parts whereon they lie; by which means the vessels contained in these parts are rendered narrower, and oftentimes so
1 compressed,

compressed, as to hinder the influx of the vital liquid, and so cause a gangrene and a sphacelus. This case happens more especially in those parts, where the bones stand prominent and are covered with but few integuments, as about the *scapulæ*, the *os sacrum*, the *os coccygis*, the rim of the *os ilii*, the trochanters of the thigh-bone, the heel, &c. but most frequently about the *os coccygis*; for when a man lies on his back horizontally, the bed is always more depressed in the middle but rises on each side, so that the whole weight lies on the *os coccygis*, which is covered but with very little fat; by which means the parts upon the bone being deprived, in this compression, of the influx of the vital fluid, die very soon. The only remedy is to oblige the person thus affected frequently to change his posture, and to spread very soft leather under his naked body.

Motion, attrition, &c.] When any part of the body strikes against an hard obstacle, the yielding vessels must of necessity be compressed; and this effect will follow, whether the part moved be directly thrown upon the resisting body, or be rubbed against it, or, lastly, be squeezed hard upon it. Men that are not much used to walking, shall have their feet inflamed, if they take a long journey on foot; as those that are not used to rowing, shall have their hands inflamed, that grasp the oars, and if they do not soon leave off, shall also have them blistered, and apt to gangrene.

S E C T. CXIII.

AN increase of the contraction proper to the vessel, especially in the spiral, as also in the longitudinal fibres, shall make the cavity narrower, and arises, 1. from all the causes which increase the elastick power of a fibre, canal, or viscus (31, 36, 40, 50, 51): 2. from the swelling

of the lesser vessels, when too full, whereof the sides and cavities of the greater vessels are composed: 3. By a diminution of the cause that extends the vessels, whether it be inanition or inactivity: whence it is, that when the canals are cut asunder, in a little time they become able to retain their own liquids again.

The proximate cause of all obstructions is only one, which is always simple and the same, *i. e.* the greater bulk of the matter that is to be transmitted, above the capacity of the canal that is to transmit.

And the causes given of this were either the arctation of the canal, or the increase of the bulk to be transmitted through it. The first cause assigned for the arctation of the canal was external compression, the causes of which have been reduced to four classes in the preceding paragraph. We are now to consider that angustation of the canal, which arises from the increase of its contractive power.

That our vessels have such a power, is beyond all doubt; for it is by this power that the arteries contract to their former dimensions, when the heart ceases to act, after they have been dilated by the blood thrown into them from the heart. And it is as certain that this contractile power may be increased. When a fat man recovers from an acute disease, in which he has lost half his weight, his vessels are all collapsed, yet a just circulation continues, which could not be if the vessels were not full; and yet after the loss of so large a quantity of liquids, the vessels could not possibly remain full, unless they had contracted themselves much more considerably, than they were used to before. But this power may also very suddenly increase, as we often see, though the quantity of liquids shall remain the same. If a man be struck with sudden fear, his face shall be all over contracted, his lips, cheeks, and eyes become

pale, &c. the red blood be repelled by this contraction of the vessels towards the inner parts, and collecting in the larger passages about the heart and lungs shall almost stagnate there; whence shall arise an intolerable anxiety, a palpitation of the heart, faintings, and other great disorders, which shall often continue for the whole life after. It is certain therefore, that the vessels have this power, and that it may be increased.

The principal causes are now to be considered, which may increase this contractile power belonging to the vessels.

1. Whatever increases the elasticity of the fibres must make them, and the vessels composed of them, resist the distending liquid the more; and when that distending cause ceases, must contract their cavity with a greater force. These causes have been enumerated in the places here referred to; the repetition of one instance will at present suffice. Let an horse be well fed and stand at rest in the stable, his body will soon increase in bulk, and his lax vessels be distended; but when exercised pretty strongly every day, though his solid parts will be made more firm, he will look lanker, and the contractility of the vessels being by this means increased, the accumulated liquid will be carried off.

2. It is now absolutely certain from anatomical observations, that the membranes of the greater canals consist of a wonderful texture of vessels. Ruysch has demonstrated by his injections, that the branches of the coronary arteries are dispersed through the membranes of the aorta, as likewise through all its larger branches (*a*). There is here also found a cellular coat, with follicles also for preparing and emitting that unctuous liniment, which covers the insides of the arteries. Every sort of tumour therefore mentioned §. 112. numb. 1. may take place here: for the arteries in these membranes may become aneurismatick,

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(*a*) Epist. Anatom. Problem. III. Tab. 3. fig. 1, 2, 3.

or may be distended by an inflammation; the veins also may become varicous; the cells may grow into ampullary tumours; and the lymphaticks be turned into pustules and hydatides. It is plain too, that if these vessels which constitute the sides of the greater canals swell, the cavity of the canal which they compose must be made narrower. In stags killed after a long chase, the external surface of the aorta has been found almost black, through these vessels being too much filled with the red blood impelled into them. But it does not so clearly appear, how the tumour of these lesser vessels in the membranes should increase the contractile power of the larger vessels, since this depends on the elasticity and muscular action of the fibres only: but if it be considered, that the liquid impelled by the heart, and distending the greater canal, must by the same action press against the sides of the same canal, and compress all the lesser vessels, dispersed through its membranes, it will be plain, that when this action ceases, these vessels will presently be filled again, and so conspire with the contractility of the vessel to lessen its cavity, and in this sense the swelling of these vessels, when too much filled, may assist the contraction of the greater vessels, which are made up of these.

3. When the heart by its muscular force expels the blood contained in its cavities, and throws it into the arteries which are always full, it follows of course, that these must be distended so much as to be capable of receiving all the blood that is thrown out of the heart; and thus the systole of the heart is one of the causes which extend the arteries. The arteries therefore are then in a violent state, and as soon as the heart ceases to act, these re-act by their elasticity and muscular power, and so make their cavity narrower. But this cavity may be increased or lessened, and yet the arteries be all the time full; for if the quantity of the contained liquid be lessened, the vessels contract the more. There are two causes therefore that di-

stend the arteries, the force of the heart propelling the blood, and the quantity of blood already contained in the arteries; if the force of the heart be lessened, the whole circulation proceeds slowly; if the quantity of the distending liquid be diminished, the fault lies in the inanition. In both cases, the force which distends the vessels is lessened. But the capacity of all the vessels depends on too opposite causes, the force and quantity of the liquid which is moved in the vessel, and the contractile power of their sides which resists the distending causes; as soon therefore as the distending causes are lessened, the contractile powers will produce the same effect, or, which is the same thing, the vessels will be made narrower. For this reason, after death, the distending force of the heart ceasing, the arteries become extremely narrow from their own contractility increased by the cold, and throw out almost all their blood into the veins, which are more easily to be dilated. It can scarce be conceived, how much the vessels may be lessened, when the distending causes cease, or are much diminished. When the humours are evacuated in great quantities both by vomiting and stool in a furious *cholera morbus*, the vessels are presently so contracted, that the pulse can hardly be felt, the veins, which before were conspicuous, now quite disappear, and the face is so contracted and changed, that the sick man's friends are scarce able to know him. The womb, which is so much distended in a state of pregnancy, as soon as the foetus and secundines are excluded, presently contracts, and in a few weeks is reduced to a very small cavity. More instances of this kind might be alledged, but these will at present suffice.

Whence it comes to pass, that the canals, when they are cut in two, in a little time become able to retain their liquids.] The reason of this is plain; when the blood is thrown into the arteries by the force of the heart, the greater the resistance is towards their extremities, the more it dilates them; but when an artery

tery is cut asunder, there is scarce any resistance at all, for the blood in this case flows through the open wound; for which reason the artery is no longer distended but by the power inherent in it, and begins to contract itself by degrees, 'till at last it will suffer no more liquid to run out of it. And hence it is, that when any of the vessels happen to be half cut through, a very obstinate hæmorrhage shall ensue, which is most happily cured by cutting the adherent part entirely off, as will hereafter be shewn in the history of wounds.

S E C T. CXIV.

THE thickness of the membrane of the vessel is increased, 1. By every kind of tumour (112. numb. 1.) rising in the vessels whereof the membrane is composed: 2. By all callus's formed there, whether cartilaginous, membranous, or boney (51).

1. Of this we have already treated §. 112. numb. 1. §. 113. numb. 2.

2. It has been shewn §. 39. that by the mere activity of life, the sides of the smaller vessels being deprived of their liquids will concreate together, and that by this means chiefly the solid parts obtain their due strength. In our tender age the vessels being very weak easily give way to the distending fluid, and are lengthened in like manner; and for this reason the nearer a man approaches to his original the more he grows. In an adult person it was requisite the body should have a greater degree of firmness, and this it acquires from the concretion of the lesser vessels, and a true callosity formed in various parts of it; this callosity is proportionably greater, as the life has been longer and more active, 'till in decrepid old age, or sooner by too great labour, there arises an universal rigidity.

rigidity. But to preserve the integrity of the functions, it is requisite that the vessels should have a proper degree of flexibility, and this is diminished by callosity, and their cavity made narrower by an increase of thickness in the membranes which form it, when grown callous. We learn from the observations that have been made by physical writers, that the larger arteries in very old persons have become as hard as a cartilage, and even as a bone. In the Philosophical Transactions it is related, that in the body of an old man, who died at the age of one hundred and thirty, the aorta and iliack arteries were found almost cartilaginous (*a*). In that long-lived and much exercised creature a stag, the arteries have been often found boney at the basis of the heart, which in the shops is called *Os de corde cervi*. But such a bone has been also found in the midst of the muscular flesh of the human heart, which was four inches and a half in length, and one inch in breadth, when yet the larger vessels of the heart were not boney in the least, only somewhat disposed to be cartilaginous: nor could this circumstance be imputed merely to the effects of old age, as it was found in the body of a person that did not exceed the age of two and seventy years (*b*).

S E C T. CXV.

THE size of the fluid parts is increased so as to become unpassable, either. 1. By the change of the spherical figure into another that shall present a larger surface to the aperture of a vessel; or, 2. By the union of such particles into one mass as were before disjoined.

Having treated of those causes of an obstruction, which by contracting the cavities of the vessels prove
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(*a*) Vide acta Lipsiens. anni 1709, pag. 219.

(*b*) Academ. des Sciences Hist. pag. 34. l'an. 1726.

an impediment to the passage of the liquid that is to flow through them, it follows that we now consider those changes in the fluids that make them unable to pass the narrow parts of the vessels, through which in a state of health they ought naturally to flow.

1. The human blood, as it comes out of the heart, is made up of particles of so many different sizes, as there are different series of vessels; for through every decreasing series of vessels there flow fluid particles of a proportional size. And this was necessary in order to the vessels being all full: for if the red particles for instance were wanting, and there were no globules whose determinate size fitted them to pass through the extremities of the red arteries only, and exclude them from every other vessel of a less diameter, the blood would none of it stay in the great vessels: and the case would be the same in the next order of decreasing vessels. It appears by the microscope, that the smallest visible particle of our circulating liquids are spherical; that they pass in a manner single through the extremities of the arteries, and even this oftentimes with a kind of difficulty: as therefore the figure of these particles is spherical, it is plain, that if a globe be small enough to pass a vessel in one direction, it can with equal ease pass it in any other. But this property is peculiar to a spherical figure only; for if such a particle were of a cylindrick figure, and could pass a vessel if applied to its aperture by its basis, it is plain it could not enter it in any other situation; as Pitcairn has most solidly demonstrated in his *Opuscula* (a). When the particles of our fluids lose their spherical figure therefore, they also lose the possibility of an uniform transition through the vessels; for since by the motion of the heart and arteries, every particle of the blood has a different motion and situation every moment, it was requisite to make this motion uniform, that they should be of such a figure as might

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enable

(a) *Dissertat. de circulat. sang. per vasa minima*, pag. 25, 26.

enable them to pass through vessels in any situation; which is the case of a spherical figure only.

2. The extremities of the red arteries are so small, as to transmit but one red globule at a time; should several of these therefore congregate and unite together, they must obstruct the orifice of the canal, which is only capable of transmitting them singly; and that the blood is very liable to concretions is plain, since it coagulates presently if extravasated, and even within the vessels if it only rests a little.

But there may seem to be another cause by which the particles of our fluids are sometimes rendered unfit to pass the minute extremities of the vessels, *i. e.* by their being expanded into a greater bulk, whilst the same quantity of matter still remains. We learn by experiments, that heat enlarges and cold lessens the size of all bodies; should then the particles of the fluids be thus expanded by heat or any other cause whatever, as under a larger surface to contain only the same quantity of matter, they would not then be able to pass through the extremities of the vessels. But indeed it scarce seems probable, that any expansion of the fluid particles, can ever be so strong as to resist the condensation which they are subject to, from the action of the vessels compressing them, especially at their extremities: for there almost every single particle touches the sides of the vessel, and is strongly pressed and condensed by them; for in this manner it is by the action of the vessels, that the chyle, which is more rare than blood, is changed into it. For which reason the celebrated author of the Aphorisms has not assigned the rarefaction of the fluid particles, as one of the causes of obstructions.

Some also have been of opinion, that the grosser food mixed with the blood might cause an obstruction. But the smallness of the absorbent vessels on both the inward and outward surface of the body prevents this; besides, that whatever enters the blood must

must immediately pass through the very minute vessels of the lungs.

S E C T. CXVI.

THE chief cause of the change of figure in the particles is, when that equable pressure fails which ought to act on every side at once, and equally on all the particles, by which means they are now left to their own elasticity, and this is the case when either the motion is languid, or the vessels are relaxed, or the quantity of liquid is diminished.

As the arteries are already full, when the blood is thrown out of the heart into them, all the particles of the blood that was in them before cannot but be greatly compressed; and when this action of the heart ceases, the arteries again compress their contained fluids with violent force, by which means all the particles of the blood thus compressed by the action of the heart and arteries become condensed. And for this reason the density of the particles of the blood is always proportional to the power of the heart and arteries: and thus strong laborious people have the blood very dense and solid, whereas it is thinner and less concrecent in weak people. If blood be let within a few hours after a meal, a large quantity of chyle shall be found swimming upon the top of it; the chyle therefore is lighter than blood: and yet the same chyle, when it has been flowing with the blood eighteen hours or less, shall be changed by the action of the vessels into serum and blood, and acquire a much greater degree of solidity; and consequently the action of the vessels condenses the particles of the liquids. When the pellucid parts of animals are viewed through a microscope, it is plain that the spherical elementary particles are sometimes with difficulty

ficulty pressed through the extremities of the vessels, and are changed from a spherical to a cylindrick figure, but that after they have got through these narrow passages, they shall recover their old figure again by their own elasticity. Whence it appears, that these particles of our fluids are elastick, and that when freed from the compression of the vessels, they will expand into a larger bulk. Now whence comes it to pass, that the shape of these elementary particles, so far as we can discern by the help of instruments, is spherical? If it be considered that the blood is thrown by the heart into a conical vessel, that is reciprocally dilated and contracted, and incurvated as soon as it comes from the heart; it is plain that no particle of blood can keep the same direction for two moments together; and consequently, that the particles must be continually striking against each other: so that if any angular part should stick out in any elementary particle, that point must sustain the rotation of all the rest, and therefore will soon either be beat off or smoothed down. Add to this, that the extremities of the arteries, if cut transversely, have all a circular section, and so may give their figure to such particles as are of a flexible nature. Thus soft clay or wax rolled in the hand will assume a spherical figure. But if the causes, that by an uniform pressure do form and preserve this spherical figure, shall cease to act, the elastick particles will rebound and recede from the figure they have assumed.

Now the principal cause that produces this, is the too languid motion of the heart and arteries, from what cause soever it shall proceed. The reason of which is plain from what we have already said, and the truth of the fact is confirmed by undoubted observations. Girls in the green-sickness have a very languid circulation; whence arises an universal torpidness: and as the due discharge of the several functions depends upon the free passage of the fluids through the vessels, all these functions, whether vital, animal, or natural,

are

are either wholly destroyed or greatly disordered; the blood departing from its due solidity becomes thin like water, or inert and viscid, and incapable of passing through the vessels by reason of its glutinous tenacity. But when the action of the vessels upon the fluids is increased by steel and exercise, the florid red colour is seen again, and a due density restored to the blood. In such diseases however as these, the obstructions would be much more obstinate, but that the vessels being lax easily give way.

Vessels relaxed.] The whole action of the vessels on the fluids, is that force by which they endeavour to contract themselves into a less space, after they have been distended by the blood impelled from the heart, as has been observed and shewn before. But the strength of the vessels is lessened by their being relaxed, and all the effects of course, which depend upon the due strength of the vessels.

Or the quantity of the liquid diminished.] This will plainly appear, if we attend to the following considerations. The heart by its own force throws the blood into the arteries; the plenitude of the arteries, their elasticity, and their converging extremities, resist the blood that is thrown from the heart; for which reason the celerity of the blood flowing through the arteries, by the force communicated to it by the heart, will be proportional to the powers of the heart above the sum of these resistances: now the sum of all these resistances may be considered as a power propelling from the apex to the basis of the conical artery; whereas the force of the heart acts in a contrary direction from the basis to the apex; so that all the particles of the blood lie in a manner between two parallel planes pressing against each other; from whence will arise the greatest, and at the same time the most uniform compression. If the fulness of the vessels be diminished, which has been assigned as one cause of the resistance given to the heart, the compression of the particles of the blood, will also be lessened

lessened, upon which, their greater solidity did depend. Add to this, that when the quantity of the liquid is lessened, the vessels will be less distended, and so react less on the fluids they contain. And the same diminution of the quantity of the liquid, as has been proved before §. 25. numb. 1. and §. 43. numb. 3. will likewise weaken the structure of the solid parts.

S E C T. CXVII.

THE particles are disposed to run together and unite by rest, cold, frost, exsiccation, heat, by violent circulation and strong compressing vessels, by any acid, austere, spirituous, absorbent, coagulating cause, by viscosity or oiliness.

Two causes were assigned in §. 113, why the particles of the liquids might be so increased, as to render them unpassable, namely, a change in their figure, whereof we have treated in the preceding paragraph, and the cohesion of several smaller particles together, which before were separate, the causes whereof are the subject of the present paragraph.

By rest.] The cause of its fluidity does not lie in the blood itself; for when it drops from the nostril of the most robust and healthy man into a clean vessel, it presently turns to a solid cake: some other cause therefore is required to keep the blood fluid, which is naturally so prone to coagulate, and this is its continual motion through the vessels; for as soon as this ceases, it immediately forms itself into a solid mass. Hence that incurable palpitation of the heart, which people who have often fainted away are so subject to, arising from the concretion of the blood, while it was stagnating about the heart and in its cavities, into polypous masses which can never after be resolved. And for the same reason the like concreted masses are found after death in the heart and great vessels
of

of a body that was very sound before. The stronger a man is the greater is the danger of concretion, if his blood be at rest in the vessels. And therefore those faintings, which weakly girls are so subject to, and fall into upon every slight occasion, are seldom so dangerous, as their blood is in too dissolved a state, and scarce ever or at least very slowly concretes, though it stand unmoved.

By cold, frost.] When the blood flows from a vein into a clean vessel, it is all coagulated within three or four minutes into a solid mass, that adheres to the sides of the vessel. If the experiment be tried in a freezing air, it will congeal much sooner, and the serum then will not be expressed. But it is not very easy to determine in what degree of cold blood will congeal, because it concretes so soon of itself even in a warm air; but the serum of blood will turn to ice when exposed to the twenty-eighth degree of cold marked out in the Fahrenheitian thermometer; so that it requires a greater degree of cold than water, and probably because it is enriched with salts. It is sufficient here, that an increase of cold makes the blood to congeal the sooner. They therefore who continue so long in a swoon as to be quite cold, will find both the rest and cold conspire to produce irresoluble polypuses both about the heart and greater vessels.

By exsiccation.] When the subtle part of our liquids is by any means whatever carried off, the rest being grown thicker easily runs into concretions. Who would have thought, if we did not daily experience it, that the fine subtle dew that exhales from the extremities of the arteries in the cavities of the nose and lungs, could turn to such a tenacious and even coriaceous mucus, as it does when the thinner part of it is carried off? For the mucus that covers these parts is not such at its first secretion, but a perfectly limpid humour, and afterwards thickens by stagnation. In desperate consumptions, where by the
night-

night-sweats the blood is deprived of its diluting vehicle, it begins first to stick in the fine cutaneous vessels, and forms inflammatory pustules. For which reason Hippocrates condemns the falling into sweats in the first stage of acute diseases, both in the Prorhetic and Coan Prænotions. So after death the blood appears frequently concreted in the arteries and not in the veins, because the arteries being contracted both by their own elasticity and the cold, drive the most fluid part into the veins.

By heat.] The most fluid serum of the blood coagulates in boiling water into a scissile mass: and in diseases, where the heat very much exceeds the heat required in health, it shall immediately be disposed to concretions. For this reason the respiration then begins to grow short and difficult, and the actions of the brain to be disordered, as the blood being now almost concreted cannot pass those very minute vessels; add to this, that an increase of heat will carry off the parts that are most subtle.

By too violent a circulation, and strong compresure of the vessels.] The weaker the circulation is, the more diluted and thin is the blood, as appears in girls that are weakly: the more violent the motion of the humours is through the vessels, the more thick and crescent is the blood, as is plain in men that are accustomed to hard labour. If blood be taken away on the first day of the small-pox, it shall look well to the eye; if on the third or fourth, it shall be covered with an inflammatory crust, because the most liquid parts being carried off by the fever, and the thicker parts more closely compacted, the particles of blood begin to cohere more firmly together; for whilst there is a large quantity of thin liquid interposed between the thicker parts, the pressure of the vessels will not change their figure; but when this is carried off, the thicker parts of the blood becoming contiguous will be forcibly compressed by the action of the vessels, lose their spherical figure,

touch

touch each other in many points, and run into concretions. For when the vessels are very strong, so as to compress their fluids with great force, the finest part will be carried off, and the thicker parts united by this compression.

An acid coagulum.] All acids do not coagulate the blood: for the acidulous wines, juices of ripe acid fruits, vinegar, butter-milk, &c. rather dissolve it: but the fossil acids that are prepared from sea-salt, nitre, &c. will coagulate it. If these be injected into the veins of a living animal, the blood presently will form itself into thick lumps, and these will pass through the veins as they grow continually larger to the right ventricle of the heart, and thence into the lungs, where they will bring on a most dreadful anxiety, and soon after death. However, the orifices of the bibulous vessels are so formed as not to admit easily these very acrid acids, as they will constantly contract and close when exposed to much gentler *stimuli*. When the atrabiliary humour, which is sometimes so acid as to eat into the pavement like *aqua fortis*, erodes the vessels and mixes with the blood, it shall frequently occasion sudden death by coagulating the blood.

Austere.] Such as allom in particular, and the various sorts of vitriol, which produce the strongest coagulations.

Spirituos.] It is a known fact in surgery, that alcohol applied to the bleeding mouths of divided vessels, shall put a stop to the most violent hæmorrhages by coagulating the blood. The serum of the blood itself will presently become hard by pouring alcohol upon it. Whence we see how great the danger is, which arises from an excessive use of spirituous liquors. Upon another occasion we gave an extraordinary instance §. 28. numb. 4. of the viscera of a drunken woman, which were all found schirrous and indurated.

Absorbent.]

Absorbent.] There are some such thirsty bodies as attract all the moisture near them to themselves; so *gypsum*, quick-lime, the burnt bones of animals, the several clays baked in a strong fire, will imbibe all the liquids they approach. Such substances, if mixed with our humours, will cause them to run into concretion by absorbing the thinnest parts of them. However they are seldom mixed with the blood with this quality entire in them, because they are necessarily saturated with the liquids they meet with before. And yet in the first passages they are capable of bringing on very severe diseases, and even death itself. Pliny relates, that C. Proculus, when tormented with a violent pain in his stomach, killed himself by drinking of *gypsum* (a). Dioscorides tells us, that a man may be suffocated by drinking of *gypsum* (b).

Viscosity.] How this may cause obstructions has been already shewn in the chapter of the diseases arising from a spontaneous gluten, especially in §. 72.

Oiliness.] In fat people, when the fat is melted by violent exercise, the intense heat of the air, or acute fevers, and so thrown back into the blood, it shall often occasion sudden death, the viscosity of the oily matter obstructing the vessels and preventing all other liquids from passing through them. Whence frequently arises of a sudden a fatal peripneumony, from the obstruction hereby formed in the narrow passages of the pulmonary artery, when thus obstructed.

S E C T. CXVIII.

THE parts of a fluid become unable to pass by error of place, when a corpuscle rushes into the dilated mouth at the basis of a conical canal, and cannot pass through the narrow end of it. A plethora, an increase of motion, a rarefaction of the liquid, and relaxation of the vessel,

(a) Lib. XXXVI. cap. 24.

(b) Lib. V. cap. 134.

fel, are the principal causes that create this dilatation ; especially if when these have gone before, their contraries presently succeed.

Hitherto we have treated of the causes of an obstruction, which either lessen the cavity of the vessel, or render the liquids contained in the vessels incapable of passing through them, by an alteration in the figure of the particles, whereof the fluid is composed, or by the joining of them more closely together. There now follows another kind of obstruction, wherein though the vessels retain their due amplitude, at least are not too narrow, and the properties of the fluids are altered in no respect, an obstruction shall be found notwithstanding, namely, whilst the thicker parts of the fluids only enter the dilated orifices of the lesser vessels, and cannot pass through their extremities, but remain fixed in vessels which do not belong to them. And as in this case there is nothing amiss but their admission into an improper place, this cause of an obstruction is termed an *error in place*.

This cause of obstruction is not often mentioned by physical writers, though it be very frequently the cause of death in acute diseases. As the Antients were ignorant of the circulation of the blood, it is but very obscurely hinted at in some particular places. Galen, describing the nature of a phlegmon, says (a), *Quam sanguis calidus copiosior in aliquam animalis partem procubuit, majora ejus vasa protinus distenduntur, quæ plenitudinem non ferunt ; ab his deinceps, quæ minora sunt ; mox ubi nec in iis satis continetur, exudat foras in illa ampla spatia, quæ inter vasa sunt, sic ut etiam omnia, quæ in composita carne habentur, loca occupet ;* “ When the hot blood falls on a particular part more copiously, its great vessels are presently distended, and these not being able to bear the plenitude, soon after it enters those that are less ; and “ not

(a) Meth. Med. Lib. X. cap. 6. Charter. Tom. X. pag. 233.

“ not being capable of being contained here neither,
“ it sweats out into those large spaces which lie be-
“ tween the vessels, so as to fill up all the vacuities in
“ the solid flesh.” Whence it may be concluded, that
in a phlegmon the blood enters into vessels, which do
not belong to it.

But to make this matter very plain, what follows
deserves considering.

The largest particles in the blood are the red globules, which naturally are to be found in the greatest vessels only. Now the extremities of the arteries charged with red blood transmit the red globules singly, and with some difficulty, as has appeared by the observations made of the circulation in the pellucid parts of living animals when viewed through a microscope. All the finer parts are conveyed out of these red arteries into the smaller lateral vessels, that rise from the former; and as the red blood passes through the extremities of these arteries, so the red vein receives this red blood only. The vessel of the next magnitude receives all the liquids but the red blood, and retaining the thickest parts only, *i. e.* the serous globules, transmits the remaining thinner liquids into the smaller vessels, that rise from this serous artery. And thus from analogy it is probable, that the same law obtains in all the decreasing series of vessels. Through every one of these vessels therefore of different magnitude, there flow some particles too large to enter the smaller vessels, and these particles constitute the fluid which naturally and properly belongs to the several series of vessels. Thus the largest vessel is capable of transmitting every humour; but the lesser vessel transmits only all the thinner liquids together with its own natural liquid, from whence it has its name. The red arteries can receive and transmit all the humours; the serous arteries exclude the red part of the blood, but transmit the serous globules, and every other thinner fluid. Now the extremity of a red artery, where it passes into a vein, ought to be
larger

larger than the mouth of a ferous artery arising from it, else the red blood would not continue in its proper vessels, but would pass into the ferous arteries; so that the least red artery is the least of all the greater vessels, and the largest of all the smaller.

Should now the diameter of a lateral vessel arising from a larger vessel be by any means whatsoever increased, *e. g.* the aperture of a ferous artery, which has its rise from a red one, a red globule might be able to enter its orifice when thus dilated; but as a conical canal always grows narrower, it will shortly stick fast and be by no means able to pass through its extremity, and consequently will cause an obstruction, as the bulk of the particle to be carried through exceeds the capacity of the transmitting vessel. This may happen wherever a smaller vessel springs from a greater; and be of as many sorts as there are differences in the magnitudes of the decreasing particles in the blood, excepting the thinnest fluid of all in the whole body, for this will pass though the minutest vessels, and can never cause an obstruction by *error of place*.

The causes that increase the capacity of the vessel are chiefly these which follow.

[Plethora.] When there is too much blood in the body, the vessels that contain red blood will swell, and being thus increased in bulk will compress the smaller adjacent vessels; but whilst a red artery by being too much filled with blood is distended, the sides of the said vessel must of necessity be drawn farther asunder, and consequently the orifices of the smaller vessels that rise from these sides will be dilated, and admit thicker particles than such as they ought naturally to contain. Thus the *tunica adnata* of the eyes, which naturally has no red blood-vessels, is very apt to be red in plethorick people.

[Motion increased.] How this may enlarge the orifices of the vessels, and impel thicker liquids, into the smaller vessels, has been already explained, §. 100.

Rarefaction of the liquid.] If the bulk of the liquid be increased by an increase of heat, or any other possible cause whatsoever, while the quantity of matter remains the same, it must dilate its containing vessel; which will then admit of thicker particles than it naturally ought to contain. When a man sits by the fire, the heat will make the external parts to swell and grow more red than naturally they were wont to do.

Relaxation of the vessel.] The amplitude of the vessels depends on two very opposite causes. The liquid impelled by the heart endeavours to dilate the canals, and these by the strength of their fibres resist the impelled liquid. If these two powers were equal, the canals would always continue in the same degree of amplitude. But if the impetus of the liquid prevail, the canal will be dilated, and so much the more in proportion as the impetus of the impelled fluid exceeds the resistance of the sides of the canals. If this resistance therefore be lessened through the relaxation of the vessel, the impelled liquid will the more dilate the canals, and such particles of the fluid be able to enter them as were before excluded. If any part of the body be exposed for a long time to the vapour of warm water, it will swell and grow red, the red blood being entered into the smaller vessels dilated. This is the reason that the *tunicæ adnatæ* so often become red, because though naturally there is no red blood in them, yet they consist of vessels that are very easily dilatable. Hence Hippocrates reckons ophthalmies among the epidemick diseases, that reign in a warm moist southerly season without winds (*b*); as such a state of the air relaxes the body more than any other.

Especially if these have gone before, their contraries follow.] When a man grows hot by exercise, the force and velocity of the humours being increased hereby, the dilated vessels receive other humours than naturally

(*b*) Epidem. 3. Charter. Tom. IX. pag. 261.

naturally belong to them; and thus the whole skin throughout the body becomes red after violent running: but by rest in a warm air, and keeping the body well covered, the celerity of the motion of the blood abates, the vessels contract and repel the thicker particles, which were impelled into them, back into the broader vessels, and by degrees every thing returns to its former state: but if the body be exposed to a cold air when it is thus heated, or the man drink cold water, what terrible mischiefs will ensue? for the vessels being contracted by the sudden cold, retain the thicker fluids that have entered them, and cannot pass through their very narrow extremities, whence severe inflammations follow, and oftentimes sudden death. How often does it happen, that country people, to quench their thirsts in the summer-heats after violent labour, greedily swallow some cold liquor, and die suddenly, or have every function so changed, that scarce any appearance of their former health shall remain? When Alexander, covered with sweat and dust, went into the Cydnus to wash himself in a very hot country, and the hottest time of the day; (c) *vix ingressi subito horrore artus rigere cæperunt, pallore deinde suffusus est, & totum propemodum corpus vitalis calor reliquit. Expiranti similem ministri manu excipiunt, nec satis compotem mentis in tabernaculum deferunt*; “as soon as he entered the water his limbs grew stiff on a sudden, and he turned pale all over, and the vital heat forsook almost every part of his body. His servants received him like a dying man, and, carried him scarce sensible to his tent.” So suddenly was his strength destroyed, young and hardened as he was by warlike toils, a violent disease immediately seized him, who was perfectly well before, from which he very difficultly escaped by the skill and fidelity of Philip his Physician.

S E C T. CXIX.

FROM whence appear the causes and nature of every obstruction.

The nature of an obstruction consists only in the obstacle given to the passage of the fluid through the vessel, and the several causes have been recited, which either act by making the vessels narrower, or by inspissating the liquids, or by doing both together at the same time.

But it still remains a doubt, whether an obstruction may be formed in every kind of vessels. That it may arise in conical vessels through which the liquids are moved in a direction leading from the basis to the apex, is certain; for the particles of the fluid arrive at a narrower section of the cone every moment; and that which passed freely at the basis, may easily stick in the extremities of this converging canal, and then the liquid behind will always press the unpassable mass into a still narrower space, and so increase the obstruction. In cylindrick canals, or, as Pitcairn phrases it, in canals whose sides are parallel to the line of motion, an obstruction may by accident happen, though not so easily perhaps; for being every where of the same amplitude, the particles that could once enter it may also pass through. Yet the particles of the fluid are capable of becoming larger by rarefaction, and so for instance may pass more difficultly, but the liquid urging behind would be able in all probability to overcome this resistance. We may conceive indeed, that a fit particle to pass through a cylindrical canal, by having its bulk increased or being united to others, may possibly distend some part of the vessel, stick there, and so obstruct it; but then it would no longer be a cylindrical canal, no having the same amplitude in all places, and the obstructing matter would be driven by the direction of its motion

tion from a larger to a smaller space and then this would be the same case, as we have already described, in speaking of the arteries.

But in the veins, where the direction of the motion tends from the apex of a conical canal to its basis, an obstruction seems not possible, unless by the external compression of the vessel; for whatever has passed the narrow orifice of its vertex, will easily pass the other sections of the canal, which are continually growing larger; and though the particles of the fluid be supposed to unite into still larger particles, yet as these are not supported by the diverging sides of the veins, they will easily be carried along by the impetus of the subsequent liquid; as Pitcairn has fully proved in his *Dissertations* (a).

This is farther confirmed by the experiments made on living animals. I injected alcohol into the crural vein of a dog, and though the blood was immediately coagulated into lumps, yet these were carried along the whole length of the vein to the right ventricle of the heart, from whence being driven into the lungs, there they stuck, and raised the utmost anxiety; and though all the efforts of respiration were used by the dog to make them pass these narrow vessels, he presently died. Since therefore so strong a coagulant caused no obstruction in the veins, it is much less likely to arise from any slighter cause.

So that an obstruction does not seem possible to be formed in canals, through which during the course of life the liquids are carried by a perpetual motion, unless the direction of the motion be from a broader orifice to a narrower.

Nor is it any objection, that the hepatic duct, as also the *ductus communis choledochus*, which have something of the nature of veins, are often obstructed, though they convey the liquid secreted by the liver from narrower passages into a larger duct; for

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(a) *Dissertat. de circulatione sanguinis in animalibus genitis & non genitis*, pag. 107, 108, 109.

the *ductus communis*, after it has pierced the first coat of the duodenum, descends a small space between this and the next ; and then piercing the other, it runs a considerable length between the second and third, and then at last opens into the cavity of the intestine. Now a great many causes may occur to render this orifice narrower, or even quite to close it, and by this means interrupt the free course of the bile, which is apt to run into concretions when it stagnates, as anatomical observations have shewn.

It is certain however, that polypous concretions and obstructions arising from thence, may arise in the larger receivers and sinuses, where the venal blood is collected, and may continue for a time.

S E C T. CXX.

WHICH as soon as it arises in a living subject, hinders the passage of the matter that ought to flow through it, stops all the fluids striking against it, and sustains their action ; hence it causes the thinner parts to be expressed ; the thicker parts to be united ; the vessel to be extended, dilated, attenuated, and broken ; the stagnating fluid to be condensed ; the function that depended on the integrity of the vessels to be destroyed ; the vessels that are washed by it to be emptied and dried ; the capacity of the vessels to transmit the liquids to be diminished ; the quantity of liquids and their velocity in the vessels that are free and open to be increased, and of course all the mischiefs that may arise from hence.

Having already explained the causes and nature of an obstruction, we are now to examine the effects, which will follow from an obstruction considered as a cause.

Which as soon as it arises in a living subject, hinders the passage of the matter that ought to flow through

through it.] For in a dead carcase, where there is no motion of the liquids through the vessels, an obstruction will do no mischief. This is plain from the very definition of an obstruction §. 107. where an obstruction was said to occur, when the passage of a liquid through its canal was stopped, from what cause soever it might proceed.

It stops all the fluids striking against it, and sustains their action.] Whilst life subsists, the fluids are carried through the vessels with a continual motion and considerable force; for, as we have observed upon another occasion, when a toe is cut off, the blood will fly out from the divided arteries to the distance of two feet and upwards. When therefore a canal is obstructed, the liquid is driven against the obstructed place, with a like quantity of motion to that which would carry it to the extremities with a proportionable degree of celerity; and this force, thus acting upon the obstructed place, is renewed at every contraction of the heart and arteries. And as the obstruction is formed in a conical canal, through which the liquid is driven from the basis to the vertex, it is thrust onward every moment into a still narrower place. And thus both all the liquid that strikes against it is stopped at the obstructed place, and the matter that obstructs continuing unmoveable, must of course sustain the whole impetus of the liquid that presses from behind.

The thinner parts are expressed, and the thicker united.] An obstruction seldom takes place (unless from external compression or by error of place) but in the extremities of the vessels. What then will be the consequence, if, for instance, it happen at the extremity of a red artery? The blood has in it several fluids consisting of lesser particles, and every larger canal has also smaller branches issuing from its sides, which are capable of transmitting the most fluid parts, but not the thicker. When then the action of the heart and arteries propels the blood against the obstructed

obstructed place, the thinnest fluids being placed as it were between two opposite presses, will pass into the smaller lateral canals, and the thicker parts only will remain, be pressed against the obstructed place, and increase the obstructed matter. But sound blood of itself naturally tends to concretion, and especially when deprived of its thinner part, and so the mischief will be by this means increased. When in a true phrenitis, the blood flowing in the carotid and vertebral arteries is stopped at the extremities of the vessels, and can pass no farther, the heart persists in propelling more blood, and it may be as yet sound blood too, through the arteries every moment; but the most liquid parts are all the while expressed into the lateral branches, and the thickest are accumulated, till at length the greater part of the vessels in the cortical substance of the brain are plugged up, and the disease rendered incurable. For which reason it is so bad a symptom in a peripneumony, if the blood drawn from a vein be too dilute and scarcely disposed to coagulate; as this shews, that the thinner parts only pass through the lungs, while the thick are accumulated.

[The vessels extended, dilated, attenuated, broken.] When the heart propels the blood into the arteries, they are distended, both because they are already full, and because the liquid impelled is greatly resisted by their converging extremities. For if they were empty, or there were no resistance at their extremities, the blood impelled from the heart into the arteries would flow freely through them, and not press their sides to recede from the axis of the canal. The fuller therefore the arteries are, and the greater resistance there is at their extremities, the more they are dilated by the blood driven from the heart: but an obstructed canal is full in the place that lies before the part where it is obstructed, and withal the greatest resistance is there given to the impelled liquid; whence its dilatation must necessarily follow. When the free
course

course of the blood in the veins is interrupted by a ligature, they presently swell just below it; but when a vessel is extended, the solid fibres of its sides are drawn to a greater distance from each other, the points of contact are lessened, and the cohesion debilitated, as has been already explained §. 25. numb. 3. The sides therefore of the vessels are less able to resist the causes which distend them, and for this reason are still more dilated, 'till at length there is no cohesion at all, that is, a rupture ensues. If it be now considered, that an obstruction is seldom formed in the greater vessels, and almost constantly in the least; and that the largest of these least, *i. e.* the extremities of the red arteries are not equal to the tenth part of an hair, the great danger of their rupture when obstructed will easily appear: but this danger will be still much greater if the obstruction be in the serous or lymphatic arteries, &c. For this cause it is, that when a violent inflammation has continued for four or five days, upon a rupture of the very small vessels that were obstructed, occasioned by their being too much distended, a gangrene or at least a suppuration follows; and in this case it would be in vain to expect that the obstructed matter should be dissolved.

But the vessels that are obstructed, and by that means dilated, must necessarily compress the other vessels that lie next them, and of course cause also obstructions in them too, and thus the mischief spreads.

The stagnating fluid is condensed] By the expression of the most liquid part, and the compaction of the thicker part; as has been observed before.

The function that depended on the perfect circulation through the vessel is destroyed.] Thus we begin to see how many kinds of diseases may arise from an obstruction only; for as all the functions depend on a free circulation of the fluids, when this is interrupted, they are all disordered, or quite cease. If any polypous masses concentered near the right ventricle of the
the

the heart shall pass into the lungs, life would cease at once. Should the branches of the *vena porta* in the liver be obstructed, no bile would be secreted, &c. Since therefore an obstruction may arise from so many causes, it may perhaps seem strange, that the functions are not more frequently destroyed or disordered hereby, as in all probability some vessels or other, dispersed through the several viscera, are frequently obstructed; but anatomists have taught us, that the vessels in the viscera almost every where communicate by their branches; and hence though some should be obstructed, yet the circulation continues free in the rest, nor is the proper function of the viscera immediately disordered upon every slight obstruction.

The vessels that are supplied from it are emptied, dried.] In many parts of the body as the blood is brought by a single vessel only; v. g. each kidney is supplied with blood by a single artery, and so the axillary arteries provide one for each arm, &c. should these be obstructed, it is plain, that no other supplies could be conveyed to these parts, which derive from hence their vital blood. But when the vessels are no longer distended by any liquids, they will collapse or contract themselves at least to their smallest diameter. Should the obstruction be removed in the larger vessels, the liquid rushing in with a violent force would distend them again, whether collapsed or contracted; but should the smallest vessels thus collapse from a like cause, and continue in this state for some time, their sides would soon grow together, and remain unpassable during life, and their functions, depending upon a free passage of the liquids through them, would all be lost. It often happens, that acute inflammatory diseases of the head, shall leave behind them incurable deafness or blindness during the whole life after; the reason of which probably is this, that when the greater vessels were obstructed by the inflammation, the lesser ones derived from them, being compressed or collapsed, were by this means grown together. When in an
apoplexy

apoplexy the several actions of the brain cease to be performed, it is seldom cured, without some defect in one or other of the functions, which for the most part proves incurable.

The capacity of the vessels cannot transmit the liquids diminished; the quantity, &c.] When the obstructed vessels cannot transmit the liquid impelled by the heart, whatever cannot pass through the obstructed vessels must be contained in those which have their passage open; for as the obstruction is almost always in the arteries, all that lies behind the obstructed place in the arteries, will return by the veins to the heart, for these are easily emptied; so that there will remain the same quantity of liquid to be moved, though the number of the canals in the mean time be less; by which means if any part of consequence in the body should chance to be obstructed, the other parts would necessarily be distended with a greater quantity of liquid, and suffer all the effects of a plethora; and farther, all this over-balance of liquids must either remain in the distended vessels that are free and open, or the velocity of the circulation must be so increased, as that, the same quantity of liquid remaining, the heart may in a given time propel the blood through a less number of canals. Opening the abdomen of a living dog, I made a ligature round the trunk of the descending aorta: by the struggles of the animal arising from the pain it was in, all the blood of the lower parts quickly returned to the heart, whilst the least drop of blood could not be transmitted to the parts below: the poor creature soon fell into excessive agonies; his heart beat violently, his eyes started almost out of his head all streaked with blood, his tongue was turgid with blood and hung out of his mouth, a large quantity of froth was gathered about his mouth, and he soon after died. When the stomach is distended with a large quantity of meat and drink, and presses the descending trunk of the aorta, the turgid face, the red eyes, the increased pulsations, and the quicker respiration,

piration, all shew the quantity of blood to be increased in the upper parts, and that it flows with greater celerity through the vessels; hence it is that we meet with so many instances of persons, who have died of an apoplexy immediately after a full meal, among the writers of observations.

And thus all, &c.] Which are certainly without number; as all the functions depend on a free passage of the fluid through the vessels; but an obstruction when formed, and interrupting the free passage, is capable of disordering both all the functions in general, and every distinct function in particular; and as a disordered function is a disease, there may therefore as many diseases proceed from an obstruction, as there are functions to be disordered.

S E C T. CXXI.

FOR which reason, according to the diversity of the obstructed vessels and the obstructing matter, those effects (120) shew themselves in different symptoms.

As the great number of diseases, that may arise from obstructions, hinders us from describing every particular distemper, it will suffice to set down the principal heads upon which the different effects of an obstruction depend. For the symptoms will be quite different, when an inflamed blood, rendered incapable of passing by reason of its thickness, obstructs the very tender vessels in the cortical substance of the brain, or the much firmer ones in the kidneys. We have reason to hope, that such an inflammatory obstruction in the cortical substance of the brain will be much more easily cured, than if an atrabilious matter were to obstruct the same vessels with its pitchy tenacity. For the obstructing matter is sometimes of such a nature, as to dissolve by degrees, if not too
much

much pressed from behind by the impetus of the vital humour, and sometimes resisting all endeavours to remove it, it will bring on an incurable disease. If a confirmed schirrhus, or a malignant cancer, that will not admit of being extirpated, are the cause of an obstruction, he must be a bold man that in such a case will presume to promise a cure.

S E C T. CXXII.

IN the arteries which carry red blood may arise an inflammation of the first sort : in the yellow serous arteries may arise either a red inflammation by error of place, or the yellow one proper to that vessel, known by its being hot and yellow : in the lymphatick arteries may arise either the yellow inflammation of the second sort, by their being so dilated, as to admit of foreign particles by an error of place, or the pellucid hot sort proper to that vessel : in the larger arterial lymphatick vessels there may arise the hot oedema ; in the lesser ones pains without any apparent swelling. The pinguiferous, osseous, medullary, nervous, bilious vessels, have each of them their distinct kinds.

In the arteries which carry red blood may arise an inflammation of the first kind.] The general idea of every obstruction supposes, that the bulk of the substance that is to pass, exceeds the capacity of the vessel through which it is to pass, as has been defined §. 107. This therefore may happen in every vessel through which a liquid flows, in the least no less than the greatest, but the red blood naturally is found only in the largest vessels ; so that if any obstruction be formed in these canals, the thickest part
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of the blood, that is, the red, will stop in the extremities of these vessels; if the force of the vital liquid presses upon the obstructing matter from behind, it will form an inflammation in the largest of the smaller vessels, and will be called an inflammation of the first kind. But as the smaller orders of vessels take their rise from the larger, if the circulation of the humours be interrupted in these, nothing hardly can enter the lesser vessels derived from them, and consequently death must soon follow, either of the whole or of the part.

In the yellow serous arteries a red inflammation by error of place, or the yellow kind proper to that vessel, which is hot and yellow.] The next vessel in size to the red vessel is the serous, which receives every other part of the fluid except the red; and yet if they be dilated near their origin, these serous vessels may sometimes admit the red globules, though not transmit them through their extremities; and thus this will form an obstruction by error of place, as we have observed §. 118. and in this case there will be a red inflammation arising from an obstruction in vessels that are naturally not red. But as the thickest part of the blood, by the change of figure or the union of its particles, may cause an inflammation in the greater vessels peculiar to the said vessels; so may the thickest part of the liquid, that flows in the serous arteries, if stopped at their extremities, cause an inflammation peculiar to these vessels; and as this may happen, though no red blood gain admittance into these vessels; so this inflammation will not be red but yellow.

In the lymphatick arteries dilated a yellow inflammation of the second kind by error of place; or a pellucid hot kind peculiar to this vessel.] The next vessel in size to the serous, carries a liquid that is not distinguishable by any colour, the red and the yellow parts being excluded by the narrowness of these vessels, but a serous yellow particle may enter their orifices

fices dilated, and thus cause a yellow inflammation by error of place. The thickest part also of this liquid may become unable to pass the lymphaticks by the common causes of obstructions, and so make an inflammation peculiar to these vessels. The same doctrine may likewise be applied to all the decreasing orders of vessels, of which we can say nothing but by analogy only, there being no anatomical views of them to be taken.

Hence it appears, that the red blood-vessels admit but one sort of inflammation, *viz.* that which arises from their own proper liquid being grown unfit to pass; but the rest of the smaller vessels may admit of two sorts, one from an error of place by receiving a thicker liquid into their dilated orifices; the other from their own liquid grown incapable of passing through them.

In the larger lymphatick arteries an hot oedema.] How far this division of the vessels into finer is continued no one can tell. The large vessels when they are inflamed, being distended with coloured liquids, fall under the notice of our senses by a tumour and change of colour in the part affected; but where the vessels are so fine as not to admit of coloured liquids, either naturally, or by error of place, then, though these vessels be inflamed, the place affected will not change its colour. Yet these vessels when full of a distending liquid, though pellucid and uncoloured, may increase the bulk of the part, and raise a tumour. *Οἰδηματα* originally was a general name given to every kind of tumour, as has been observed §. 112. but the word afterwards was more particularly applied to cold watery tumours. But as in this case there is an heat, which is the attendant of all inflammations in the greater vessels, such a tumour is therefore called an hot oedema; but this occurs only, when there is an inflammation in the larger lymphatick arteries.

In the lesser vessels pains without an apparent tumour.] The smallest vessels of the body escape the

notice of our senses, and almost beyond conception, as has been proved by undeniable arguments. The *punctum saliens* in the first stamen of a chick moves all the liquids in the vessels, and how minute must these all be! The wonderful structure of the nerves, the distinct actions of the brain in giving motion by the nerves, which are distributed to the several parts of the body, to every muscle as the will directs, the organs of sense exciting such distinct ideas in so lively a manner in the mind, all these sufficiently make good the point we are speaking to. Should now these very small vessels be inflamed and swell, the bulk of the part will not be sensibly increased, and yet the most severe pains will follow: for even in the sharp gout and rheumatism there is often no apparent tumour. For these diseases are always of a milder nature, when the parts affected swell.

The pinguiferous, boney, medullary, nervous, bilious vessels have each of them their distinct kind.] According to the different humours which are in the vessels, and the fabrick of the several viscera which they constitute, different disorders will arise from their obstruction. If the pinguiferous vessels be obstructed, the fat will soon corrupt by the heat and stagnation, and grow exceeding rancid. The vessels of a bone, when they are inflamed, will produce a caries, exfoliation, exostosis, tophi, &c. if the very tender vessels in their cavities, which secrete the medullary oil from the blood, be inflamed, the marrow by being corrupted and closed up within the cavity of the bone will produce terrible diseases. The nerves themselves when inflamed will produce the sharpest pains, and whilst thus affected become entirely useless as to their office of being the instruments of sense and motion. The bilious vessels when obstructed will prevent the bile, that is secreted by the liver from the venal blood of the abdominal viscera, from being conveyed to its proper place, which will then fall back again into the blood, bring on a bilious

lious cacoehymy, together with the many disorders consequent thereupon.

S E C T. CXXIII.

WHOEVER understands what has been delivered (107 to 123) of the seat, nature, matter, causes, and effects of obstruction, will also know the signs of an approaching or actually present obstruction, as also its effects.

The design of this paragraph is to point out the diagnosticks of a present obstruction, with the prognosticks of a future, as also of the effects consequent thereupon; but these are all easy to be deduced from what has been said in the foregoing chapter.

Its seat.] An obstruction from an external cause compressing the vessels may happen in any part of a canal; but if it be from any of the other causes mentioned, it will be generally in the narrowest part of converging conical vessels.

Nature.] Which appears by the definition §. 107. to consist only in the excess of the bulk of the liquid to be transmitted, above the capacity of the vessel through which it ought to pass.

Matter.] Which is capable of being as various as there are different sorts of fluids in the canals, or even of the same liquid by its different diseased state, may cause distinct concretions, which is another source of the great variety there is of obstructions. The blood, for instance, may become unfit for circulation by its inflammatory tenacity, it may form itself into polypous concretions, or may grow viscid by means of a cold mucous gluten, &c.

Causes.] These have been enumerated already, and act either by contracting the vessel, by increasing the size of the particles of the fluid, or by error of place.

Effects.] These are also various according to the vessel, the matter, and the impetus of the liquid against the obstructed place.

And how from these things known to form the proper diagnosticks and prognosticks, has been observed already §. 27.

S E C T. CXXIV.

AND knowing this diversity, it will not be difficult to point out the cure proper to each.

As to the cure of an obstruction, no general rule can be given, nor any thing said with certainty 'till its cause be known. It is commonly said indeed, that it is adviseable in every obstruction to relax the obstructed vessel, that so it may the more easily yield to and transmit the obstructing liquid. But if the obstruction arises from an error of place, of what service can it always be to relax the vessels? Certainly it was shewn §. 118. that the relaxation of the vessel was justly reckoned one of the causes of this disease. Another general indication in the cure of an obstruction, has been said to be the dissolution of the concremented obstructing matter: but if the Physician knows not by the history of causes of what nature the concretion is, he will still be at a loss to know what he is to do. For blood concremented to an inflammatory tenacity, requires a different cure from the same blood grown too viscid from a cold unactive mucus. And so in the rest. The cure therefore will be various according to the variety of the cause, from whence the obstruction is known to proceed.

S E C T. CXXV.

FOR that which is from external compression (112) indicates the removal of the pressing cause, which is to be taken from its following description where it is possible.

In §. 112. you have all the causes enumerated, which have been found to form obstructions by external compression of the vessels: for unless the compressing cause be known, and removed after it is known, it will be plainly impossible to cure the obstruction arising from it; and therefore in the fore-cited number, these causes are divided into four classes, for their more regular and easy discovery.

When this cause is known, the next enquiry will be, whether it is possible to remove it or not. *V. g.* as the ampullary tumours, which from the different thickness of their contained matter are called atheromata, steatomata, melicerides, when situated in the external parts, where the hand may come at them, cannot without some difficulty be taken away, what hope is there of eradicating resembling tumours, when seated in the inward parts of the body? When a pregnant womb is distended, and from its situation presses upon the iliac veins, as is sometimes the case, an oedematous tumour falls on the legs and thighs, which cannot at present be removed, but will cease of itself when the womb is discharged of its burden and sunk in its dimensions. When a confirmed schirrhous or a cancer, which cannot be extirpated, is the cause of obstructions, what known remedy is there left to be applied? The case is the same in many other instances. The Physician, however, who can discover the cause of such a disease, and shew that it is incurable, is no less skilful, than he that can cure a disease, which will admit of a remedy.

The cure of the other causes mentioned §. 112. is to be drawn either from what has been already advanced, as, for instance, the plethorick swelling; or from what will follow hereafter in distinct chapters concerning an inflammation, suppuration, schirrhus, &c. luxations, fractures, &c. But in case the compression arises from any external application to the body, as by garments, bandages, ligatures, &c. the cure is plain and easy.

S E C T. CXXVI.

THAT which arises from the increased contraction of the fibres, is known by the signs whereby the too great contraction of any bowel, vessel, or fibre is known (34, 36, 40, 50, 53); as also the obstruction arising, when this contraction proceeds from the second cause (113. numb. 2.) is clear by the signs of its cause; as is the other, which we have attributed to some preceding inanition. (*Ibid.* numb. 3.)

The subject of this paragraph are the signs, which shew when the cause of the obstruction depends upon an increase of the contraction properly belonging to the vessels. Now in §. 113. there were three distinct causes alledged, which increased the contraction of the vessels. The first of these was the increased elasticity of the fibres, vessels, and viscera. But the signs of an increased elasticity have been already described, under the articles relating to the too great rigidity of the fibres, vessels, and viscera, in the places here referred to. The second cause was the too great distension of the very small vessels, which compose the sides of the greater, but this is known by the signs of too great fulness related in the history of a plethora. The third cause, which was more particularly attributed to a preceding inanition, is known
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by any great evacuations which have gone before, by the countenance sunk, the weak small pulse, the dry tongue and mouth, and the loss of strength.

S E C T. CXXVII.

THIS sort of obstruction (113, 126) is to be cured 1. By the remedies that correct the too great contraction of a fibre, vessel, or bowel (35, 36, 38, 54, 55); 2. Especially by applying their virtue to the place affected, which is done chiefly by vapours, fomentations, baths, liniments; 3. By those means that empty the vessels, whereof the membranes are composed, when too full, to which purpose evacuants in general are of use, and especially by such applications to the vessels as shall relax, dilute, resolve, attenuate, deterge, evacuate; 4. By such remedies as may resolve the callus already formed.

1. These have been treated of in the places referred to; and there it appeared, that art may be of great use in the cure of the diseases, wherein the too great rigidity of the solid parts, has taken away the æquilibrium between the impetus of the fluids and the resistance of the solids, which is required in a state of health. But it is farther to be observed, that certain wonderful stimulants, and even the passions of the mind, are capable of very suddenly and very powerfully increasing the contractility of the solids. When the vapour of kindled sulphur is drawn with the breath into the lungs, they are immediately so straitened in every vessel, as to transmit nothing; and hence it is, that the smoke of sulphur is so fatal to all the larger animals. Oil of vitriol, applied on a pencil to the intestine of a dog opened alive, makes it so contract as to close the cavity entirely. A drop

of vinegar thrown into the eyes shall make the eyelids shut so close, that no force can open them. Now unless a Physician knows how to remove or weaken the power of these stimulants, neither will he be able to cure the contraction caused by them.

How much the affections of the mind may increase the contractility of the vessels, is obvious to common observation. If a man be struck with a sudden fright, he turns pale, and his countenance falls, the vessels being contracted; and if we consider, that the same may happen within that we see outwardly in the skin, it is plain, that most stubborn and strange diseases may arise from hence. I have seen a healthful woman, who upon a sudden fright had a tumour immediately rise in her breast, which, though treated as well as possible, hardened into an irresoluble schirrhus.

2. If the whole system of the solids were too rigid, the remedies proper to take it away should be applied both to the whole body and to every part of it within and without. But if the ailment lie only in a particular part, why should all the vessels be relaxed? In this case it is sufficient to have recourse to a topical remedy, and to apply it only to the part affected. This is to be done chiefly by

Vapour.] Warm water of itself will soften the harder parts of the body; but if turned to vapour, will discharge this office much more effectually. The very hard horns of stags, if exposed to the vapour of warm water will become so soft, as to be capable of being cut. I have seen the joint of the elbow, when grown immoveable from an obduration of the ligaments, made as flexible as ever, by being exposed an hour in every day for two months together to the vapour of warm water. Whenever therefore this vapour can be commodiously directed to the part, it is to be preferred to all other methods.

Fomentations.] Which are made of watery substances, with very smooth herbs boiled in them, such

as

as mallows, marsh-mallows, &c. linseed, oats, &c. Woollen cloths dipped in these decoctions are applied to the parts affected, and over these is laid a bladder soaked in oil to prevent exhalation, and over all hot tiles made into a proper shape to fit the part so as to keep the fomentation warm: by this means the part is kept continually in a vapour-bath. Such applications made to the side of a pleuritick person, shall frequently give great relief.

Baths.] Especially of vapour; for a part that is under water is compressed by the water, but the vapour of water relaxes universally, as has been before observed. It has been found, that warm water dropping from an higher situation on the part affected has done wonders in such topical diseases. By this method I have sometimes cured the most chronical and stubborn tumours at the knee.

Liniments.] If made of the mildest oily substances. The stiff hides of animals well rubbed with oil will become flexible. Such a soft oil is found in all the parts of the body which are designed to be flexible. All the muscles and tendons are covered with oily sheaths. And there is a fat unctuous liquor, which lubricates all the ligaments that connect the articulations. But this oil is every where found to be perfectly smooth and mild, and has no kind of acrimony in it: and therefore it would be very wrong to think, that those acrid burnt oils, such as the Galbaneta of Paracellus, &c. are more proper for this use. Where too great rigidity is the only circumstance that is amiss in the solids, then the smoothest oils drawn from vegetables, fresh marrow, ointment of marsh-mallows, and the like, are of signal service; especially if applied to the parts after they have been deterged by baths or fomentations, and well dried.

3. It was observed §. 113. numb. 2. that it appeared plainly from anatomical injections, that the sides of the greater vessels were made up of lesser, which therefore by being too much filled, might make the
cavity

cavity of the greater vessel narrower, which was composed of them. If the emulgent arteries, for instance, inflamed in their membranes, should be so contracted in the smaller branches dispersed through the substance of the kidneys, as to prevent the secretion of urine, it will bring on an ischury, and this, perhaps, is sometimes the cause of this disorder, when it happens in acute diseases. In hunted animals, killed after a hard chase, the coats of the greater vessels have been found quite inflamed and turgid with blood. The cure of this disease will be obtained by

Evacuants in general.] We have nothing here but general remedies to apply, and the artificial evacuations are confined almost entirely to the larger vessels. Bleeding for the most part is of the greatest benefit in this case; for thus emptying the large vessels, the lesser vessels which form their sides are less compressed, and the force by which the liquid is impelled against the obstructed place is diminished; and in case the quantity of blood taken away be large, so as to endanger swooning, the pressure of the vital liquid from the basis of the vessel to the vertex being by this means removed, the smaller vessels will be enabled to contract and repel the liquid which obstructs them in the larger vessels. But if remedies are capable of being applied to the part affected, the methods recommended above are by all means adviseable; thus, for instance, if an ischury happen from this cause in an acute disease, and the patient finds in himself no disposition to empty the bladder, it is plain, that the seat of the disease must be somewhere about the kidneys; then after the general evacuations premised, fomentations are to be applied to the loins, and clysters injected, because the colon lies very near the kidneys, and thus the remedy may be applied as near to the part affected as can be.

How laxatives, diluents, resolvents, attenuants, and detergents act, has been already explained §. 54. pumb. 4.

4. A callus, as was said §. 112. numb. 1. is made by the compression and concretion of the smaller vessels after their liquid has been expelled; in which case the vessel becomes no longer pervious, but is converted into a concreted membrane; so that a callus has neither moisture nor sense. The vessels indeed as to matter remain the same, and only differ in their not being able to transmit any liquid. Yet a callus, if pared off from the skin, shall grow again, although no vital liquid flow through it. And this seems to arise from the concreted extremities of the vessels being gradually protruded by the vital liquid; as also because the open extremities of the vessels that are next the callus are compressed by it; and thus though it be pared away, or rubbed off, it shall shew itself again, as we learn by daily experience. But how difficult it is to take away a callosity, when it is once formed, will be seen in the following paragraph.

S E C T. CXXVIII.

BUT that kind of obstruction, which arises from this cause, is seldom if ever to be cured. Emollients and laxatives are the principal remedies. Whence appears the unavoidable necessity of death, and the great difficulty of prolonging life by any medicines whatsoever.

I much doubt, whether ever a concreted vessel became pervious again. For how should it possibly be done? Would you separate the concreted sides by increasing the motion of the vital liquid, the sides of the vessel next the callus, through which the liquid is to flow to it, will sooner be broken; besides by an increase of motion, the pervious vessels when pressed against the callus, will become flat and callous too, and so will rather increase the disorder. The only hope of cure is, when the skin is callous, to prevent
all

all attrition; and by degrees the outward surface will wear off, and the vessels below as gradually protrude the concreted parts. The hands grown hard by labour will grow soft by idleness, and yet, perhaps, the callous place will never perspire again from open vessels. But if an external callus can never, or not without great difficulty, be resolved, what remedies shall be used, or what course be taken, when any of the internal parts are hardened into a callus.

Emollients and laxatives are the principal remedies.] For by these the hard cover, that lies on the vessels below, wherein there is life, is softened so as to separate from them, especially if resolving medicines be given in large quantities inwardly at the same time, in the spring-season, when every part begins to grow turgid: some men suffer intolerable pain from a callus in the soles of their feet, so that they cannot walk; which arises from the parts underneath, wherein there is life, being oppressed and inflamed by the callus that lies upon them. And yet if the callus be fomented night and day with a decoction of milk and flour of linseed, it will begin to grow soft, to be raised and separated. But then the part under it appears smooth and polished, and does not perspire, and for this reason the callus grows again; to prevent which, as much as possible, the best method is to keep the place covered with soft wash-leather, in order to prevent all attrition.

Whence appears the unavoidable necessity of death, &c.] It has been shewn §. 39. numb. 1. and §. 55. that life necessarily destroys itself: for to the perfection of its actions it is required, that the vessels be duly flexible, *i. e.* so as to be able to yield to the distending fluid, and recover their former capacity again. But it was there shewn, that the actions of life necessarily strengthen the solids by degrees, which then resist the impulse of the fluids the more; 'till at length growing quite rigid, they will not yield at all to the liquids that are propelled from the heart, and of
course

course the heart cannot be evacuated ; whence follows that most easy kind of death in extreme old age without any disease. If the human body be considered in its various ages, it will appear, that a great change is made at various times in the firmness of the solid parts. In an infant just born every part is soft, and full of liquids ; the whole surface of the body perspirable, the vessels lying all open in every point ; and even the very bones almost as flexible as wax. In process of time the number of pervious vessels diminishes ; the strength and firmness of every part is increased ; the bones grow hard ; and at length in old age the whole body is dried up ; the joints which were so flexible in youth become stiff ; there is no fat to be seen ; the skin grows flabby, callous, and so deformed with wrinkles, that it is scarce perspirable ; the bones become very brittle ; the cartilages assume a boney nature ; and the vessels, which before were membranous and flexible, put on the nature of cartilages, and even of bones. And the more the efficacy of the vital actions has been increased by the animal actions, the sooner this rigidity comes on ; and for this reason such animals as have been accustomed to too much exercise grow old before their time.

Let those then, who boast that they can put off the fatal period of life, try their skill to prevent or cure the stiffness attending upon old age. Such boasters there have always been, who have dared to promise to mortals an *ἀννησία*, and even immortality itself ; and many have believed what all so greedily desire. In Galen's time a philosopher wrote a book to shew how a man might live without growing old. This he wrote in his fortieth year ; and lived after 'till fourscore, but so lean and withered, that he became a general jest ; and when his own example shewed the falseness of his doctrine, his evasion was, that it was not every man that was capable of this attainment, but only such as had a proper constitution ; and that he would make the bodies of infants,

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proper

proper for immortality, if he might have the care of them from the beginning. This he might safely boast indeed, as he himself was sure to die before ever they could come to age (a).

But as he placed his hopes of doing this in a proper diet, he was less raving than the chemists, who have pretended by giving a few drops every day to lengthen out life to a thousand years, and then they would deliberate whether it were best to live any longer. Paracelsus himself dying in his forty-eighth year, shewed how little regard was due to such vain boasting.

If any thing could contribute to prolong life, it would be such a remedy as would prevent too great rigidity : for this reason Galen recommends a moistening diet to old men (b), and in another place (c) treats of the same subject more largely.

S E C T. CXXIX.

THAT unfitness of the fluids to pass through the vessels, which depends on the loss of their spherical figure, is to be known from the causes observed (116), as they are generally discoverable by the senses.

It was shewn §. 115. that a sphere is the only figure that can pass a given orifice in every situation ; provided the diameter of the transmitting orifice be still greater than the diameter of the sphere. For all the sections of a sphere made by a plane passing through its center, and parallel to any given plane, are equal figures, and of a similar position, being all of them equal circles. As soon therefore as the elementary particles of the fluids, which ought to pass
single

(a) Galen. de marasmo, cap. 2. Charter. Tom. VII. p. 179, 181.

(b) De sanitat. tuenda, Lib. V. cap. 5. Charter. Tom. VI. p. 152.

(c) De marasmo, cap. 5. Charter. Tom. XII. pag. 183.

single through the extremities of the vessels, have lost this figure, there may arise an innumerable variety of positions, which shall prevent their passage. But how shall we be able to know, when the obstruction arises from this cause. It is certain the figure of these particles cannot be discovered in the pellucid parts of living animals, but by the help of a microscope. It will not therefore be an easy matter by the senses to make this discovery in the obstructed part of an human body. But the causes described in §. 116. by which the uniform compression of the particles of the fluid is taken away, are easily known; and therefore when we know that these causes have preceded, we need not scruple to ascribe the obstruction that is formed to the loss of a spherical figure in the particles of the fluid.

These causes were three, a too languid motion of the fluid through the vessels, and this is known by the pulse; a too great laxity of the vessels, and this is known by what has been said in §. 27. and 44. and the quantity of the liquid diminished, which is known by large evacuations having preceded, by the vessels being collapsed, and by the driness of the whole body.

S E C T. CXXX.

IT is to be cured by such remedies as restore that figure to the particles of the fluid; of which sort are, whatever increase their motion through the vessels and viscera, and such are all stimulant and strengthening medicines, as also every quick animal motion.

The human body if in health has the power, out of very different animals, of making blood, which shall consist of particles that have a spherical figure; though this figure did not before pre-exist in the particles

ticles of the aliments, but was derived from the action of the vessels and viscera, by which the aliments are converted into our nature. If this figure then be wanting in the elementary particles of the fluids, all that art can do is to restore those causes by which this figure is naturally given to the elementary particles.

Now the motion of the humours through flexible vessels, and their strong re-action on the humours which distend them, is the cause which produces this change of figure in the crude aliments. The chyle by flowing with the blood through the vessels, in twelve hours is turned into blood; and this change is so much the quicker and more perfect, as the action of the vessels upon the fluid, *cæteris paribus*, is stronger: and for this reason the assimilation is speedy in strong laborious men, more slow in such as are weak and languid.

The lost spherical figure of the particles of the fluids therefore, it is plain, is to be restored by increasing the strength of the vessels, wherewith they press the fluids they contain, and by causing their action to be exerted on the fluids more frequently in the same time, *i. e.* by increasing the velocity of the circulation.

How the strength of the vessels is to be increased, has been observed §. 28. and 47. How the velocity of the circulation, §. 28. numb. 2. And how stimulants produce this effect, §. 75. numb. 5.

In the cure of lax cold bodies that are full of mucous humours, Physicians study to revive the languid motion by the most grateful aromack stimulants, and especially by steel dissolved in mild vegetable acids. They increase the velocity and power of the circulation by friction, riding, and other exercises. Hereby the agreeable florid colour soon returns, the surest sign that red blood is again generated, and all the functions which before were languid and depraved, are again restored. Whence it plainly appears, that there is then a free circulation through all the vessels,

fels, and that the elementary particles have therefore again acquired the spherical shape, which was requisite to make them pass through the extremities of the vessels in any position.

Animal motion increased has a double efficacy in this case, by increasing the velocity of the circulation, and by making the solid parts more firm; as was observed §. 28. numb. 2.

S E C T. CXXXI.

AS the inspissation and concretion of the liquid mass may arise from so many and such different causes (117), it will also require various remedies according to their nature, as also a different method of cure: which difference as to each disease being understood, will suggest the proper means and method of applying them.

The causes assigned for obstructions, so far as concerned the fluids, were two. The change of figure in the elementary particles, and the union of such as were before separate, by both which they were rendered unpassable. This union depends on all various causes excited §. 117. many of which are just the opposites of each other, such as rest and motion, heat and cold; as nothing certain can be determined concerning the cure, unless the particular cause be first known, from whence the concretion arose. Absolute rest and an increase of motion, cold and heat, will all cause a concretion of our fluids: but causes so opposite will also require a different method of cure. When the humours become unable to pass in languid chronical diseases, the velocity of the circulation is to be increased by stimulants in order to divide the concreted matter. When an inflammatory viscosity thickens the blood in acute diseases, the vital power is to be weakened by bleeding, to make the blood

move slower. When the vessels are too weak, and do not act powerfully enough upon their contained fluids, concretions will arise in the liquids from their stagnation or want of due motion. When the vessels are too strong; and too much compress the fluids they contain, the thinnest part of the fluids is expressed, and the rest becomes more compact, viscid, and so gives rise to concretions.

In all diseases therefore, that spring from obstructions in the liquids, the nature of the cause is to be inquired into, before any thing can be determined about it. The following paragraph contains only the general method of removing concretions of the fluids.

S E C T. CXXXII.

BUT in general the concretion of the liquid mass is removed, 1. By the reciprocal motion of the vessel; 2. By dilution; 3. By the introduction, mixture, and united motion of an attenuant fluid; 4. By removing the coagulating cause.

1. Every time the heart expels its blood, the arteries are dilated, and contracted again when the action of the heart ceases; so that the liquid impelled overcomes the resistance of the vessels, and is overcome by it alternately; and the liquids are every moment rubbed against the sides of the vessels, especially in their very narrow extremities, where the elementary particles either pass single, or at least but few of them together. This attrition of the fluid by the reciprocal motion of the vessels, both prevents their concretion, and is also the best remedy to take it away when formed. The blood, as soon as it is let out of the vessels, presently coagulates, which this perpetual attrition prevents while it is in them. And as obstructions are chiefly in the extremities of the arteries,

ries, as has been shewn §. 119. and the reciprocal motion in the arteries lasts so long as there is life; so the united masses of blood, which are stopped in the extremities of the arteries, may be again in all appearance divided and resolved by this mechanical attrition. For the blood let out of a vessel, and coagulated, may be again made fluid by attrition only; for by nothing else but rubbing the red concreted part in a glass-mortar, I have been able to work it up into a frothy florid liquid.

We have a curious observation in Leewenhoeck (a), which plainly shews the efficacy of this reciprocal motion of the vessels in dissolving concreted blood. Having found a bat that was almost starved with hunger and cold, he examined with his microscopes the fine membrane which serves that animal instead of wings, but saw no motion either in artery or vein. Six hours after, the animal being somewhat more revived, he observed an oblong particle of concreted blood, which filled the whole cavity of an artery, to be protruded through it, and immediately driven back again; soon after it was protruded again, and thus continued moving backward and forward, 'till at length by this attrition the mass was resolved, and passed through the extremities of the artery into the vein. We could not wish for a clearer instance of an obstruction arising from the conjunction of the particles of the fluid; and at the same time we plainly see, how by the vital motion of the fluids through the vessels, and their attrition against the sides of the vessels, this concreted mass is again divided, and the obstruction resolved.

2. By dilution.] When a thinner liquid insinuates itself between the concreted particles, and so removes them from their contacts with each other, the obstruction is said to be resolved by dilution. Thus if in the last mentioned instance, whilst the concreted mass was moving backwards and forwards in the ob-

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structed

(a) Experiment. & contemplat. pag. 205, &c.

structed vessel, a thin liquid could have been poured to it, and rubbed along with it against the sides of the vessels, it would have resolved the concretion sooner. Besides diluents are of a watery nature, they always make the solid parts of our bodies more lax, and so more disposed to transmit the obstructing mass. Yet as diluents alone will not always dissolve concretions, we are often obliged to have recourse to other means. And therefore,

3. If such ingredients be mixed with the diluting liquid, as are known to have a power of dissolving a concreated mass into its original parts, this will be the utmost that can be expected from art. Now whatever of this kind we take down is received by the veins, and carried to the obstructed place by the power of the heart and arteries; and if the mass be yet moveable, so as to be able to pass and repass with a reciprocal motion, is continually sliding by it, rubbed against it, moved, and mixed with it, 'till it is at length resolved. But if the obstructing mass stick fast and remain immoveable in the extremities of the vessels, then the attenuant liquid can only press upon it from behind, but cannot be moved or mixed with it, and in this case the concretion is very difficult to be resolved. This seems to be the unhappy circumstance, when the best diluents and attenuants given inwardly in great quantities prove ineffectual, and are not able to dissolve the blood when concreated by an inflammatory viscosity.

4. By removing the coagulating cause.] If this can be done, but for the most part this is very difficult. If for instance the blood be coagulated by acids, there are bodies which are known to attract them; but if the coagulated blood stick fast in the extremities of the vessels, and be closely surrounded by the sides of the obstructed vessel, it will not be easy to come at the obstructing coagulum. Besides, those very strong acids do not only coagulate by interposing themselves between the parts of the blood that did not cohere before,

before, but in a moment, and as it were by the meer touch, cause the masses, which before were separate, to cohere together ; so that though you mix an alcali, which shall immediately attract the acid, with blood that has been coagulated by an acid, yet the blood will not return to its former state of fluidity. If the coagulation arise from spirituous fermented liquids, it will be equally or rather more difficult to conquer it, because the coagulation will remain, though the spirituous substance be expelled. For if serum be coagulated by alcohol, it will not dissolve, though the coagulating cause be expelled by heat that is so mild as not to make the serum run into concretion. But if the blood be coagulated by frost, we can extract the icy spicula by a prudent application of very cold water ; but in what manner, and with what caution this is to be done, will be explained hereafter in §. 454.

S E C T. CXXXIII.

Reciprocal motion is given to the vessels,
 1. By whatever moderates the distending causes, as bleeding ; 2. By whatever strengthens the vessels (28, 29, 45, 46, 47, 49) ; 3. By friction and muscular motion ; 4. By stimulants.

1. The causes that distend the arteries are the blood with which they are filled, and the force of the heart propelling more blood into them when they are already full. Now to continue the systole and diastole in the arteries, the distending causes must not be entirely taken away, for if the artery be not distended, neither will it be contracted afterwards. But these causes should be so moderated, as that they may in their turn give way to the causes which produce the systole of the arteries ; for which reason it is here rightly said, that the distending causes ought to be moderated. For if when the arteries are distended, they could

not empty themselves into the veins, either because the veins were already too full, or the extremities of the arteries were obstructed, then the heart would still go on to distend them, but they would not be able to contract themselves again, and so the reciprocal motion would cease. For every vessel that is too much distended, if it remains thus full, is a dead vessel. And if this were to be the case in all the vessels, death would instantly follow; and whatever thus happens in some of the vessels, there is no longer any circulation in them, but the liquid stagnates in them and remains unmoved.

There is then left only one remedy to take away this plenitude, and that is to open a vein, in case the veins are too full to admit any liquid from the arteries. But if the obstruction lies in the extremities of the arteries, and the blood is by this means accumulated in the arteries, the section of an artery then becomes much more adviseable; for as the free passage of the blood from the arteries into the veins is hereby interrupted, the opening of a vein cannot take away the too great fulness of the arteries. For which reason in acute diseases the bursting of a little artery in the nostrils, is often seen to relieve this plenitude by the salutary assistance of nature. And therefore it was, that Hippocrates so carefully enumerates the signs which point out to us when nature attempts to relieve this way, lest we imprudently disturb or prevent this salutary evacuation.

But besides, bleeding lessens the powers by which the heart propels the blood into the arteries; for by bleeding, life may be diminished even to swooning and death. From whence it is plain, that by this means the distending causes are lessened most effectually.

We see this very clearly in very plethorick people, & in whom the circulation is apt to be stopped, as the vessels are too much distended to be able to contract themselves, the pulse also begins to grow languid, and they

they at last become stiff like statues. But as soon as this fulness is abated by bleeding, the vessels contract again and propel the distending humours, and then the powers revive, which before were in a manner lifeless.

The great efficacy of these evacuations to dissolve obstructions, is visible from observation. A person labouring under a very sharp pleurisy, to avoid the severity of the pain, shall forbear to breathe, and be suffocated by the omission. And yet bleeding shall often give relief in an instant, and sometimes even absolutely take away all the pain, the small vessels contracting and repelling the obstructing particles into vessels that are large. Galen, when a young man, being admonished in a dream, cut asunder the artery in his own right hand, that runs between the forefinger and the thumb; he let it bleed, 'till it stopped of itself, for so the dream directed; and by this means was cured of a fixed pain in that part where the liver joins to the diaphragm. Another person had the artery in the ankle wounded, which bled on 'till Galen came and cut through it, but hereby he was cured of a pain in the hip, which had been troublesome to him for near four years (a).

2. The reciprocal motion of the alternately contracted and distended artery, arose partly from the force by which the heart impels the blood, and partly from the elasticity and muscular force of the artery, by which it is able to contract itself. But it was shewn §. 26. that the weakness of the fibres causes an extension of the vessels that are made up of them, and lessens the force of their action on the fluids they contain; when this therefore is the cause why the vessels contract with too little power, there the indication is to strengthen the vessels.

But too much distension of the vessels itself is frequently the cause of this weakness. Thus if the blad-

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der

(a) Galen. de curand. ratione per venæ section. cap. 23. Charter. Tom. X. pag. 451.

der be distended with urine too long, it becomes well nigh paralytick, and loses all its power of contraction; and on this cause perhaps many appearances in diseases depend. A violent ophthalmy often leaves the vessels so lax ever after, as to be distended and grow red by every the slightest cause: in these cases strengtheners prudently applied are the only remedies. Acute inflammatory diseases of the head often leave the functions of the brain disordered, though the fury of the disease may have been long abated, the pulpos vessels of the critical substance of the brain remaining still obstructed: by gradually dissolving the obstructing matter, and increasing the strength of the vessels, this disorder may be overcome. But if the Physician persist in the debilitating method of cure, it shall leave them ever after incurable ideots.

The manner and means by which the vessels are to be strengthened, are to be found in the places cited.

3. Frictions cause a successive and repeated compression and relaxation of the vessels, and so supply the place of their reciprocal motion. By pressing the liquid from the apex of the vessels to the basis, we may turn the arteries into veins, and so bring the obstructing matter out of the narrow into broader parts of the arteries, into which it presently returns again when the vessel is relaxed. If this be often repeated, it will be exactly the same case as Leeuwenhoeck saw in the bat; *i. e.* the obstructing matter will be divided and attenuated by going backwards and forwards, 'till at last it can pass into the veins.

Observation shews the great use of frictions in resolving obstructions. I have seen an indurated parotid gland, after many very good applications have failed, resolved by being well rubbed with woollen cloths for an hour together twice a day, after having been exposed to the vapour of warm water and vinegar. The like also has been seen in the glands of the neck, when they have been strumous.

Muscular

Muscular motion also is of singular use in this case, as the motion of the venal blood being accelerated thereby, it occasions the heart to contract oftener and stronger, increases the circulation, and more frequently distends and contracts the vessels alternately in a given time.

4. It is certain from observation, that there are such medicines, as if given inwardly, and applied outwardly to the body, shall increase the motion of the humours in whole or in part; these we call stimulants. These when mixed with the vital fluid, that is moved through the vessels, seem either by their bulk and figure (which are so contrived as to communicate the violence of their motion in very few points to the parts whereto they are applied) to irritate the sides of the vessels into more frequent and strong contractions; and their action may be explained by the rules of mechanism: or else they are such, as having no manner of acrimony discoverable by the senses, are yet found by their certain effects (though we do not know the manner of their operation) to have the power of increasing the motion of the fluids through the vessels, and the attrition of the vessels against the fluids. But of these we have already treated in §. 75. numb. 5. and in §. 99. numb. 2.

S E C T. CXXXIV.

WATER dilutes, especially if warm, whether given in drink, injected, received in steams, or outwardly applied; and then propelled to the place where the matter to be dissolved adheres: to this head belong derivation, attraction, and propulsion.

The only diluent with respect to our liquids, if you except the fat parts, is water; and whatever else is called a diluent is so only upon account of the water it contains.

contains. To dilute, properly speaking, is to separate the particles that are united, by mixing and interposing watery particles between them. But to this there is required a certain degree of heat : for cold water rather coagulates the liquids and constricts the vessels, and upon both accounts is prejudicial in this case. Hot water makes the blood run into concretion in a moment. The best degree of heat is that which but a little exceeds the warmth of a sound body. This is to be applied to the part affected, either by vapour, fomentation, or cataplasm, &c. or to be drank, or given in clysters, or resorbed by the veins which lie on the internal or external surface of the body : it either way soon mixes with the blood, and is then distributed equally through all the body. But the indication chiefly requires, that the diluent water should be applied to the parts obstructed, rather than to any other part.

Now we are supplied by art with such remedies, as are capable of increasing the impetus and quantity of the vital liquid in any part of the body. And these are such, as lessen the resistance in the part, towards which the case requires that the humours should flow in greater plenty, and with a greater force. But whatever part of the body the liquid is to be driven into, it will be resisted by the fulness and strength of the vessels. Whatever therefore will render the vessels more empty, or take off from their lateral resistance, will cause the humours to flow to that part in greater quantity and with greater motion. Fomentations, cataplasms, and the vapour of warm water, will do this effectually, by relaxing the sides of the vessels ; cupping-glasses also by taking off the pressure of the atmosphere from the part, to which they are applied, will make the resistance less : and frictions, by emptying the veins, will likewise cause the arteries also to discharge the liquid they contain the sooner into them ; for this reason they increase the velocity of the circulation in the part, and by this increase of celerity
cause

cause a larger quantity of humours to flow through the said part in the same given time; and if the parts be scarified, upon which the cupping-glasses are placed, the resistance will be still rather lessened by the depletion of the vessels. Farther, whatever when applied to the body shall stimulate the vessels into quicker concretions, for the same reason shall produce the like effect; which is the reason why sinapisms, blisters, &c. are so very serviceable in this case.

Experience clearly shews us, how very useful these applications are. If any part of the body be exposed to the vapour of warm water, it will soon swell and grow red, by the greater quantity of liquids derived to it. When in a phrensy all the functions of the brain are disordered, what great relief is often obtained from baths, blisters, and cupping-glasses applied to the lower parts! A pleurisy is never more happily cured than it sometimes is by keeping the side affected continually supplied with emollient fomentations, and wrapping it up warm night and day. The most dissolving remedies applied to strumous glands in the neck avail but little, unless fomentations be applied too.

Such applications therefore as have power to make the vessels, that belong to the place where the obstruction is fixed, to be more speedily emptied, and more easily filled, are called *derivatives* and *attractives*, as by their means the water applied to the body, received into the veins, and mixed with the blood, is conveyed to the part affected in a greater quantity in a given time.

Propellants are such remedies as increase the motion of the humours through the vessels; for by this increase, the water also that is mixed with the blood is carried along with the greater celerity. These however act in an uniform manner upon the whole body; but such medicines as attract and derive, determine the effect of the increased motion only to the obstructed part.

When

When these particulars all conspire together, such diseases are often cured, as have been judged by many to be desperate. In the *spina ventosa*, and the venereal disorders of the bones, which are apt to elude even the most efficacious remedies, it is usual to give large draughts of the decoction of Guaiacum wood, and when the body has imbibed as much as it can well contain, to excite a greater motion, and even raise a fever, by applying the fumes of burnt brandy to the naked body inclosed within a blanket, by which means the decoction of the Guaiacum is propelled more swiftly through all the vessels. In the mean time the part affected is either wrapt up in flannels, which have imbibed very emollient fomentations, or so placed as to receive directly the vapour of the burning spirit. And thus the efficacy of the remedy will be derived and attracted to the part affected, and frequently work a cure.

S E C T. CXXXV.

A Tenuants are, 1. Water; 2. Sea-salt, sal gem, sal ammoniac, nitre, borax, fixed alkaline salt, and volatile salt; 3. Soaps made of alcalies and oil, whether native, composite, fuliginous, volatile, or fixed, as also the bile; 4. The mercurial preparations, which are to be conveyed to the proper part by such remedies as have the power to derive, attract, or propel.

1. Water holds the chief place among attenuants. The chemists have advanced, that all things have grown from water changed by the seminal principle of things, and in the last effect of art and nature might be resolved into water again. And for this reason they have allowed it an almost universal power of resolving. For the elementary particles of water have this property, that, when separated from each other

other by heat, (for water concreted into ice has not the least dissolving power) they can receive in between their interstices the particles of the bodies that are dissolving them, and so perfectly sustain them, as to carry them along with them through all places, whither they themselves are capable of penetrating, unless they happen in their passage to meet with any other bodies that attract them more strongly, than the water they are dissolved in does, for then the water must let them go; v. g. a grain of sea-salt dissolved in water so as to disappear entirely, and though it be diluted with ten pints of water, yet every single drop of water will have its proportional quantity of the salt, which thus dissolved will penetrate through all the vessels where the water itself could. But it appears from experiments, that the finest fluids of the body that are discernible by the senses, consist of water, or at least the greatest part of them. Fresh urine emits a steam, which if it be collected in clean vessels appears to be water with something spirituous in it, which sends forth a smell. The like vapour exhales from blood just emitted. That very fine fluid that perspires from the surface of the whole body, if any one will be at the pains of collecting it, is found to be water, but with some other very subtle part lurking in it, that can only be distinguished by the smell, which, whether it be water or something else, does not yet appear. It is plain however, that water may pass through the perspiring vessels, whereof upwards of an hundred thousand lie within the same compass as a grain of sand, according to the calculation of Leewenhoeck. If therefore an obstructing particle is capable of being attenuated and dissolved by water, it will pass with the water through the smallest vessels, and so the obstruction will be resolved.

Hence it is, that when but a moderate quantity of the water is drawn off, our humours become oftentimes unpassable, and are attenuated again, when that is

is restored : *v. g.* the exhaling arteries deposite a most subtle liquid in the cavities of the nostrils, which turns to a tenacious mucus, when the most moveable aqueous part is carried off, and yet this mucus may again be attenuated by water and dissolved.

But this attenuating power of water, is not capable of dissolving every concretion that is found in the human body. It attenuates indeed and dissolves all saline, mucous, mucilaginous, gelatinous, cold, pituitous, and soapy concretions ; but the inflammatory spissitude of the blood, all oleous, sebaceous, calculous concretions, &c. are incapable of being dissolved by water ; however there are other means to dissolve these, though water alone cannot do it, such as salts, soaps, &c. but then these also require water for their vehicle to convey them to the obstructed place. Water therefore is of almost universal use in opening obstructions, whether it acts as an attenuant, or as a vehicle to transmit other solvents to the place obstructed.

2. Sea-salt, sal gem, sal ammoniac.] These salts, being much alike in many of their qualities, have also a resembling power of attenuating. The two former when given inwardly mix indeed with our humours, but pass off by urine in a great measure unchanged ; for which reason, though they pass through most of the vessels of the body, yet they undergo no alteration from their action. Now whatever is taken down, and cannot be changed by the powers of the body, will constantly excite a greater motion, and thus will act also as stimulatives.

But sal ammoniac, which is lighter than the other two, and more like the native salts of the blood, is more capable of being changed by the powers of the body, and of a very penetrating nature, and is therefore generally preferred before the rest, and justly commended as one of the greatest deobstruents both in acute and chronical diseases.

The action of these salts seems to consist in this, that when they are mixed with the humours dissolved, and conveyed to the obstructed place, from a kind of constant attrition by the action of the vessel against the obstructing mass, they divide it by their weight and figure, and thereby make it passable through the vessels; at the same time increasing the action of the vessels by their stimulating property.

And how great their efficacy is, appears plainly from observation. When the vessels under the unbroken skin are corrupted by a contusion, and the blood concremented into a mass, which is still entire, these salts dissolved in water and applied to the part, shall most happily dissolve it. Those, who indulge themselves too much in eating large quantities of sea-salt, shall have their blood so dissolved, that it can scarce be retained in its vessels; and hence shall oftentimes arise very violent hæmorrhages, partly from the blood's being too much dissolved, and partly from the too great acrimony of the humours which erodes the vessels.

Nitre.] The modern nitre seems quite different from that of the antient; for there it seems to have been of an alkaline nature, or perhaps it was the sal ammoniac to which they give this name. Pliny (a) says, *nitrum in picatis vasis adferri, ne liquefceret; calce respersum reddere odorem vehementem; in testa operta exuri, ne exuliet*; "that nitre was brought in vessels that were well pitched over that it might not melt; that if it was sprinkled over with lime it emitted a very strong smell; and that it was burnt in an open vessel that it might not fly." By these qualities it agrees very well with sal ammoniac, but not at all with the modern nitre. In another place (b), where he is speaking of the invention of glass, he says, *famam ferri, quod appulsa nave mercatorum nitri, cum sparsi per littus epulas pararent, nec esset cortinis atollendis lapidum occasio, glebas nitri de nave subdidisse, quibus accensis permista arena littoris, translucens nobilis*

) Lib. XXXI. cap. 10.

(b) Lib. XXXVI. cap. 26.

his liquoris fluxisse rivus, & hanc fuisse originem vitri;
 “ it is reported, that the seamen of a ship laden
 “ with nitre coming ashore to dress their victuals,
 “ for want of stones to raise their kettles on, took
 “ lumps of nitre out of the ship, which kindling and
 “ mixing with the sand made transparent streams of a
 “ noble liquor, and that this was the original of glass.”
 This story shews the antient nitre to have been of an
 alkaline nature; which induced Mr. Boyle and some
 others to conclude, that the *Ægyptian soda* was the
 nitre of the Antients.

But the nitre of the Moderns seem to have been
 unknown to the Antients, and of a nature strangely
 ambiguous between vegetable, animal, and fossile: it
 is found in desert uninhabited parts of the East Indies,
 lying in a very thin crust upon the surface of the earth,
 especially after great rains; in other parts it is got
 by boiling a black sort of earth: it is found in old
 buildings, church-yards, stables, dove-houses: and
 some plants have an essential salt, which is collected
 by inspissation only of the expressed depurated juice,
 and is in every property exactly like nitre.

This nitre, if free from all sea-salt, remains dry in
 the air, dissolves entirely in water, is the lightest al-
 most of all salts, is a very great attenuant, can be
 changed by the powers of the body, is cooling, and
 of the greatest service in acute diseases, where there
 are obstructions from an inflammatory density in the
 blood. It is preferable to sea-salt or sal gem, because
 it is lighter and can be subdued by the body; to sal
 ammoniac, because that is in great measure made up
 of a volatile alkali, which is very prejudicial in these
 diseases; especially as it possibly may be set free from
 its connecting acid of sea-salt, when it meets with pu-
 trified or alkaline humours.

Borax.] This is a very wonderful salt, whose nature
 is not well known, and its history confused even in the
 best writers. Some reckon it to be the chryfocolla of
 the

the Antients: but Dioscorides (c) commends in the chryfocolla, a bright green refembling the colour of a leek, and at the end of the fame chapter tells us, that it will excite vomiting, and fometimes prove mortal: and elfewhere (d), that a glue is made of urine and Cyprian brafs fit for to folder gold (*ἀρμόζουσα ἐπὶ τῇ γυμνῇ κίλλᾳ*). So Pliny (e) commends the colour of chryfocolla when it is like green corn: and fays, that in Nero's fhews the fand of the Circus was ftrewed with chryfocolla. He alfo obferves, that it excites vomiting, and that the goldfmiths ufe it for foldering gold; and then adds, that in this cafe it is mixed up with a compofition made of Cyprian brafs, the urine of a youth under age of puberty, and nitre.

So that by its colour and effects the chryfocolla of the Antients feems to have had in it a mixture of copper; whereas it appears from the tranfactions of the Royal Academy of Sciences (f), that fome of the greateft chemifts, when investigating its properties, could find no copper in borax; but that it is of a nature fomewhat alkaline, and has great affinity with the *foda* of the Egyptians; only it is lefs alkaline, and has befides in it an earth that will turn to glafs, and a neutral falt that as yet is not well known.

It is commended much as a deobftruent, and ufed in the moft obftinate difeafes; as it acts partly by its wonderful ftimulus, and partly by its attenuant faline power.

Fixed alkaline.] This is the offspring of art only, and not of nature, fo called from the herb kali, which when it is burnt in an open fire leaves afhes behind abounding very much with falt. This falt is obtained from various forts of vegetables, but without any difference, except only in greater or lefs degree of acrimony. It is chiefly ufed where cold, fluggifh, and vifcid pituita prevail; but where heat, putrefaction,

VOL. I.

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trefaction,

(c) Lib. V. cap. 104. (d) Lib. II. cap. 99. (e) Lib. XXIII. cap. 5. (f) L'an 1728, 1729, 1732, &c.

trefaction, or great driness predominate, it is never safe to use it.

Volatile.] All animals and vegetables that have hitherto been brought to the trial, yield a volatile alkaline salt when putrified. All animals yield this salt by simple distillation. The humours of animals that are not alkaline, if mixed with a fixed alkaline salt, will yield a volatile alkaline salt. Some very acrid plants, such as mustard, scurvy-grass, water-creffes, onions, &c. contain this salt, which shews itself by the smell as soon as the plant is broken, and is easily obtained by distillation. And the volatile alkaline salt, obtained from all these several substances, when purified according to art, appears to be in every respect one and the same.

These salts have very near the same use as the fixed alkaline; but being very volatile, are dissipated with the least degree of heat and fly off; for which reason they have not so durable an effect; but if they are confined close to any part where their action is wanted, they destroy all before them. Thus if a volatile alkaline salt be applied to the skin, and covered with some sticking plaster, it will burn it, 'till it bring on a gangrenous incrustation; for wach reason there need of great caution in the use of them.

3. All soaps contain an oil so accurately mixed with a salt, as to be capable of being dissolved in water without separation; for this is required, before they can be called soap. Many of the soaps are native, *v. g.* honey, which in the chemical examination, as well as by its excellent uses in many chronical, but more especially in acute diseases, shews itself to be of a very dissolving soapy virtue. Sugar also, so much used of later ages, though not unknown probably to the Antients, which burns in the fire, is dissolved in water, and may be reduced to crystals, has the like virtue. The fresh or inspissated juices of the summer fruits well ripened, have an incredible power to liquify and dissolve whatever they are mixed with.

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The juices of fresh-gathered herbs have their oils and salts so well united as to deserve to be called soaps; nay some of them have the virtue of cleansing foul cloths like soap, as, for instance, the juice of soapwort.

If the oil of vegetables or animals be united in a certain manner with acrid fixed alkaline salt, it becomes a soap, which has the former detergent and dissolvent quality of the salt, *i. e.* the power to dissolve all oleous, fat, resinous, pituitous, amurcous substances, without its eroding acrimony. This soap therefore diluted, or rather dissolved in the humours of the stomach and viscera, is almost an universal deobstruent, effecting those things with safety, which more acrid dissolvents could not do without danger.

The most efficacious soaps are made artificially, by uniting a very pure and attenuated vegetable oil, with an adulterated fixed or volatile alkaline salt, Thus alcohol of wine unites with a volatile alkaline salt into a wonderful soap, called by the name of *Offa Helmontiana*. The same alcohol, when freed from all its water, makes a true soap, when incorporated with a fixed alkaline salt perfectly dried by the fire. The æthereal oil of turpentine, when it is united, though not without difficulty, with an alkaline salt, yields a most excellent soap called *Starkeyan*. The more pure and subtle the oil and the salt are, of so much the more excellent use is the soap, which is made from them,

Fuliginous.] Smoke, as it rises up from an open fire, is received and condensed in the chimney, and sticks to the sides in black flakes; this is a true volatile coal enriched with a volatile fat oil, called foot. Its chemical analysis into water, salts, oils, and earth, shews its soapy nature. Pills of foot gilt over to prevent their giving offence in viscid diseases, have often done great service from their soapy attenuant nature.

Bile.] It is a true native soap formed in an animal body. Soon after the crude aliment has begun to be digested in the stomach, this is thrown in upon it in order to render the whole one uniform mass, and make it dissolvable in water. This is so well known, that silk-scowerers make use of it to clean their silks of their greasy spots.

The painters dilute their fine colours with bile to make them spread the more equally. But its dissolving power is most visibly seen in those diseases, where by being hindered from passing in its usual courses it regurgitates backward into the blood, for then it turns it all to water; and for this reason it is, that a long jaundice is almost constantly followed by a dropy. Bile is kept in the shops inspissated into an extract to prevent its putrefaction, and is given in pills. This inspissated bile, if it be rubbed on the swoln bellies of children, will dissolve the concretions formed in the intestines, and carry them off by stool.

According to the different nature of the disease we use a different soap. The Venetian soap, as it is called, which is made of very pure expressed oil and a genuine alkaline salt, liquifies all the humours without any commotion; but in acute and putrid diseases it is not quite safe to give it; in this case honey, sugar, the fresh or inspissated juices of the summer fruits, are to be preferred; especially if we intend to resolve an inflammatory thick matter. If cold, inactivity, or a mucous disposition prevail in the humours, the acrid footy soaps, or those made of the distilled aromack oils and volatile alkaline salt, such as the *sales oleosi volatiles* of the shops, are to be preferred; as also those that are made of alcohol and fixed alkaline salt, &c. But where there is any putrefaction either present or expected, there we forbear to make use of bile, as it is so apt to putrify.

4. Mercurial preparations.] Quicksilver is so called, because it shines like silver, and trembles as if it were alive. Whence Dioscorides called it *ιδρυμενον*,
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and Aristotle ἀεργον κίνητον, moveable filver. The Antients were acquainted with it, but condemned it as poisonous. Dioscorides (g) said, that quicksilver when drank wrought the same mischief as litharge, which he had before described (h); and elsewhere (i) he advises, that it be kept in glass, or lead, or tin, or silver vessels, for it eats through and destroys all others; it has also a poisonous power when drank, and erodes the inward parts by its gravity. Pliny also condemns it (k), calling it *vomicam liquoris æterni*, the poison of all things; saying, that it eats and breaks through the vessels, spreading its pestiferous venom: and hence afterwards he condemns the use of *minium* (l), from which quicksilver is got by boiling, as a rash practice. Galen (m), in a short discourse on quicksilver, says, that he had no experience of its deadly qualities when drank, nor whether it was alike fatal when externally applied. And in the like manner the use of quicksilver was prohibited even by the later Greek Physicians. The Arabians were the first that began to use it externally in cutaneous diseases. Afterward it was commended, but only externally, in venereal disorders, 'till John de Vigo first gave red precipitate inwardly. Afterward they gave it in its native form in the pills called *Barbarossa*; as the celebrated Astruc has fully shewn in that compleat treatise he has wrote of venereal diseases (n).

This wonderful metallick fluid, which is the heaviest of all metals except gold, is also the most simple and most easily divisible, since at the fire it all flies away in a volatile smoke; and how much must its surface be increased in respect of its solid bulk, before so very ponderous a metal can be sustained by the air. It has farther no sensible acrimony, for it may be put into the most tender eye or a fresh wound without gi-

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(g) Lib. VI. cap. 28. cap. 110.

(h) Ibid. cap. 27.

(i) Lib. V.

(k) Lib. XXXIII. cap. 6.

(l) Ibid. cap. 8.

(m) Lib. IX. Simplic. Medicament. Charter. Tom. XIII. pag. 270.

(n) Pag 126, &c.

ving any pain. Yet this seemingly bland inert medicine, if applied to the body by liniments or plasters, &c. or received by the pores in the form of a vapour or swallowed in small and frequent doses, changes the whole body in the most extraordinary manner, liquifies and dissolves all the blood into a kind of feid colluvies, and then carries it off by salivation, or sometimes by stool.

In this case there first comes on an universal sickness, a greater heat than usual, a fever; the strength in a manner begins to fail, the appetite to decay; this is followed by a violent thirst, with a cadaverous smell issuing from the mouth; the gums, tongue, palate, tonsils, sublingual, and other neighbouring glands, begin to swell and grow hot and painful; the teeth rise, the tongue is eroded with white and painful ulcers, especially about the sides and tip, where it is contiguous to the teeth; the inner part of the cheeks and lips is affected in the same way; the whole face swells, and the lips, as they grow big, turn back in a frightful manner; and then a stinking viscous humour runs out ostentimes in a vast quantity, exulcerating every place it passes by. This lasts for several days; and when by degrees all the forementioned symptoms abate, the whole body appears exhausted and pale. Though in some, either by their taking cold, and so stopping the salivation in the beginning, or by a particular idiosyncrasy, the virtue of the remedy falls upon the stomach and intestines; and then these parts suffer the same effects as we see to arise to in the mouth. In this case the patient complains of most cruel and tormenting pains in the stomach and bowels, attended with a large discharge of thin watery stools, which are extremely fetid, and often by sinking the spirits at once bring on fainting-fits, and sometimes prove fatal.

This is at least certain, that quicksilver dissolves, attenuates, divides all the humours, whether they pass off by salivation or stool. For we have known a
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very healthy fat man, by unwarily anointing his skin with a quicksilver ointment to cure the itch, to have fallen into a very violent salivation, which has lasted for twenty days, and when he has come out of it, he has been quite pale and lean; the blood being by this means dissolved, and the fat all attenuated and carried off.

Pitcairn (o), who deduced so many beautiful inferences from the common laws of all bodies, was of opinion, that the weight of quicksilver alone was sufficient to account for these wonderful effects: nay he boldly adds, that if gold could be reduced into such a form as to mix with the blood, its powers would be proportional to its weight, and that it would exceed all other medicines as much in virtue as it does in weight.

For as quicksilver is divisible into very minute particles, and is almost fourteen times heavier than the blood, when it has entered the veins, passes through the lungs, and is projected from the left ventricle of the heart with the blood into the arteries, it will have the same celerity with the other particles of the blood; and the quantity of motion in a particle of quicksilver, will be to the quantity of motion in a particle of blood, as the weight of the quicksilver is to the weight of the blood. The particles of quicksilver then acting with such a force on the particles of the blood, will divide and attenuate them; and these being dissolved will lose all their redness; the salts and oils being in like manner attenuated will be set free, whence will arise the stink and putrefaction; and the attenuated humours will pass out through the mouths of the vessels that are dilated by the force of the quicksilver thus acting upon them with so great violence. And all these symptoms must of course be continually increasing, as the particles of the quicksilver will retain the motion impressed upon them

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(o) *Dissertatio de causis diversæ molis, qua fluit sanguis per pulmonem, natis & non natis*, pag. 37, 38.

a considerable time; it being demonstrable, that the retardation of equal bodies of different density, moving in the same liquid with equal velocity, will be in an inverse proportion to their densities.

This simple explication of the wonderful effects of quicksilver from its known gravity has been esteemed by many sufficient. And yet when I consider of this matter seriously, I find some doubts to arise in myself concerning it, which I will here lay before the reader, not through any inclination to find fault with the gentlemen, whom I highly honour, but merely out of the regard I bear to truth, and a sincere desire of being better informed, in case I am in the wrong.

From these general properties of quicksilver it does not seem possible to explain clearly, why the humours, when they are dissolved, should rather pass off by the salivating ducts, than by any other parts of the body.

The mercurial preparations of the shops produce all the same effects when given in a small dose, as are wrought by a much greater quantity of crude quicksilver. And is it likely, that the quicksilver should be separated in the body from its other parts, so as to recover its native form and original weight, when this cannot be done by art but by a strong fire, and with the addition of such other materials as shall very powerfully attract the acid that is united to the quicksilver? And though it should be granted, that the quicksilver might again resume its form when in the body; yet what reason can be given, why a few grains should do that which a whole ounce of crude quicksilver is scarce able to perform?

To this difficulty I know it may be replied, that the particles of quicksilver, when divided most minutely, and stuck full of saline darts, may so much the more attenuate whatever it meets with, by having the most concentrated acid united to so weighty a metal. But let it be considered, that in making the white precipitate of the shops, which is the lightest
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of all the mercurial preparations, the quicksilver, that was dissolved in the spirit of nitre, is thrown out by a solution of sea salt poured upon it, and the powder that remains behind is by repeatededulcorations left almost insipid and mild. And yet by giving twenty grains of this or less in divided doses, I have often seen a violent salivation raised. Now the lightness of this precipitate, and the small acrimony of the salts, that are united to the quicksilver in this powder, seem to oppose this opinion.

A person of distinction labouring under a confirmed weakness of sight in both eyes, was ordered, by a quack, to snuff up two grains of a powder, which he afterwards owned was turbith mineral, and was immediately seized with a vomiting, sweating, and purging, with a large discharge of urine, as also of an humour from his mouth and his eyes, which lasted for ten or twelve hours, so that his head was very much swollen: however, on the third or fourth day his sight returned by degrees, and within a philothical month became more acute than ever, as you have the story in Mr. Boyle (b).

Now from this relation it appears, that all the effects of quicksilver may arise from a little mercurial powder, touching only the inside of the nostrils.

Pure quicksilver, contained in a dry clean glass vessel, by mere mechanical shaking only, yielded a soft black, very fine powder, of an acrid metallick taste, something like brass. Quicksilver rendered perfectly pure by sixty-one distillations, yielded a larger quantity of the like powder. Quicksilver exposed to 180 degrees of heat for many months in conical glass cucurbits with a flat bottom, closed with a chemical glass phial inverted, yielded a like powder in every respect.

But this powder distilled with a strong fire out of a glass retort returns to quicksilver again, except a few grains only of fixed matter.

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(b) De Utilitate Philos. Experiment. pag. 346, 347.

By the simple distillation of quicksilver out of a clean glass retort was produced a red shining powder, easily friable, of a very acrid, metallick, nauseous, penetrating taste, very difficult to be got out of the mouth, capable of throwing the whole human frame into disorder for a considerable time, and disposing it to excretions: yet this powder in a violent fire was almost wholly changed into quicksilver again (*q*).

Hence it appears, that quicksilver, without any addition, by attrition only, or the action of the fire, may acquire a very acrid quality; and by a greater fire losing all acrimony, it will re-assume its old form again. Does then its efficacy depend on the common properties of all bodies? Or rather should we not ascribe it to its own singular nature, which is to be known only by experiments? In the mean time it may suffice for the Physician to know its effects when applied to the body, though he knows not the particular manner whereby it acts. The virtue of other remedies is no less obscure to the enquirer: for who has ever explained the manner by which scammony carries off the blood by stool after it is converted into a putrid water? Whoever has thoroughly understood the wonderful properties of antimony and its several preparations, &c?

All the remedies here recited should be directed as much as possible to the places where the obstruction is formed: by such applications as are derivative, attractive, and propellent; of which we have treated in the preceding paragraph.

S E C T. CXXXVI.

THE coagulating cause is drawn out by the attraction of another body that is still more attractive. Thus acids are attracted into alcalies, and oils into alcalies, &c. this is chiefly to be discovered by chemical experiments.

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(*q*) H. Boërhaave de Mercurio in tranfact. Philosoph. Anglicanis. No. 43c, Mens. Novemb. & Decemb. An. 1733.

It appears by chemical experiments, that some bodies have this property of attracting and uniting with other bodies; v. g. if one drachm of oil of vitriol be diluted with three pints of water, and oil of tartar *per deliquium* be then poured on it, it will unite with the acid of the vitriol, and form with it into a composite salt. If quicksilver be dropped by degrees into melted sulphur, and incorporated with it by continual stirring, these two will unite together into a black mass, which though it be exposed to the action of a strong fire, will neither revert to the quicksilver again nor fly off, but will both be sublimed together and form cinnabar. In this case, if you would make the quicksilver separate and become fluid again, you must add such a body to this concreted mass of sulphur and quicksilver, as shall more powerfully attract the sulphur and unite with it, and then you shall have your quicksilver pure as before. This is done by mixing filings of steel with the cinnabar, and setting it over a strong fire in a retort, for the sulphur will in this case unite with the steel, and the quicksilver being set free will pass into the receiver.

Many other experiments might be produced to shew, that bodies, when united together, are capable of being disjoined by the admixture of another body, which shall attract the particles of one of them more than they attract each other. Thus silver dissolved in *aqua fortis* is precipitated by adding copper; and the dissolved copper will be precipitated in like manner by an addition of steel, &c. Alcohol dissolves and unites with distilled oils; pour water on them, and the fluid that was before limpid will turn milky, and by degrees the oils, that were before incorporated, will separate.

The great difficulty here is, that the coagulating causes are not so easily discovered; and that the coagulation of our humours may arise from quite opposite causes. Do not rest and too much motion both coagulate the blood? Do not the greatest cold and burning

burning heat convert its elementary particles into insoluble masses? Who can explain the manner how a schirrhous should suddenly arise from a great fright, which yet I have seen, and which never after could be resolved by the application of any remedy? Besides, when our humours have been once concreted by a coagulating cause, it often changes them in such a manner, that they will not recover their former fluidity, though the coagulating cause be taken away. If any one doubt of this, let him try if he can make the blood fluid again by adding alcalies to it, which has once being coagulated by oil of vitriol.

However we have one fair instance, that the resolution of coagulated humours may be performed by educing the coagulating cause, and the fluidity so far restored, as to have the humours pass freely again through their respective vessels; when the extremities of the body are deprived of all vital influx of the humours by an extreme frost; if then the part be covered with snow, or immersed in very cold water, only not cold enough to be frozen, the icy spicula will by this means be drawn out, life will return to the part, and the concreted fluids recover their former fluidity.

Many other resembling cases may lie hid perhaps in nature, wherein the concretions formed in our humours might possibly be dissolved by educing the coagulating cause. The elements of the stone are contained in the most limpid urine of an healthy man; these when they are united cohere so as not to be resolved by any art. Whoever therefore could take away the power, whatsoever it be, that unites them, would dissolve the stone. In the mean time it is not a rule, that a great acrimony must always be joined to a great resolving power: soft oil will dissolve wax, which will not yield to *aqua fortis*; the unactive white of a boiled egg will liquefy myrrh, which is so tenacious, that it can hardly be dissolved by any other menstruum. The very great usefulness of such remedies,

medies, when they are found, make them well worth searching after.

S E C T. CXXXVII.

BUT when the liquid is driven into wrong vessels, that it cannot pass through, and by this means creates obstructions, numerous and malignant diseases are produced, so that this case deserves well to be attentively considered.

The cause of an obstruction here mentioned is that which was explained in §. 118. where, namely, the cause of the obstruction neither resides in the contraction of the vessels, nor in the concretion of the liquids, but proceeds merely from the liquids being admitted into lesser canals, than such as naturally they ought to pass through: so that though such liquids may enter the dilated orifices of the lesser vessels, yet can they not pass through their narrow extremities, and consequently will stick by the way, and stop up the vessels.

What a plentiful source of diseases this is, will appear, if we consider, that perfect health depends on the due circulation of the humours through vessels of a proportional size; and that this disease presently follows upon an increase of velocity in the circulating fluid. For if this velocity be increased by violent muscular motion, or a fever, we presently see many parts of the body grow red which were not red before, which shews that the red blood has entered the vessels where naturally it was not to be found before.

And not only numerous diseases, but such as are most dangerous too, may arise from hence. For it is easily conceived, that in the same manner as a red particle of blood enters a serous vessel, so may the other fluids of smaller size be impelled into foreign vessels by the same causes. And should an obstruction happen from such causes in the very tender vessels

fels of the cerebrum and cerebellum, on which life and humanity depend, this would occasion many mortal diseases to spring up of a sudden, and yet the causes of them might be altogether indiscernible in the dead body. Such diseases are justly called malignant.

It is plain therefore of what use it is to understand aright the nature and cure of this disease.

S E C T. CXXXVIII.

WE know this to be the case, if we know,
 1. that its causes, which for the most part are very discernible, have preceded; 2. that causes directly opposite to these have immediately succeeded; 3. and when the effects of it are plain to be seen (120, 121, 122).

Our present enquiry is, how we may certainly know that this is the cause of the obstruction.

1. In §. 118. the causes are set down which have been found to produce an *error of place*. These were a plethora, an increase of motion, the rarefaction of the liquid, and the relaxation of the vessel. A plethora is known by what has been said in §. 106. 4. An increase of motion is indicated by the symptoms mentioned §. 101. The rarefaction of the liquid is learnt from what we have observed in §. 106. 5. And we may easily find out when the vessel is relaxed by the circumstances recited in §. 27. and §. 43. and §. 44. But more especially, if an error of place be observed to occur without any signs of a plethora, an increase of motion, or of rarefaction, we may then fairly impute it to the relaxation of the vessels alone. For the mouths of the lesser vessels must of necessity be dilated, before they can receive a grosser humour, than such as before was wont to pass through them, as the narrowness, which is natural to these vessels, necessarily excludes all grosser humours. But this dilatation of the vessels must arise either from an increase

crease of the force by which the humours are impelled into the vessels, or from a diminution of the strength of the vessels, by which they resist too great a dilatation. When therefore the causes do not subsist, by which the fluids act with a greater force against the sides of the vessels, an *error of place* can only arise from the less resistance of the sides of the vessels, that is, from their being too much relaxed. And this is the cause, which very frequently occurs; for it is merely from the too great laxity of the vessels, that some people are so subject to ophthalmies, which though not very sharp, are notwithstanding very lasting. Thus, at the approach of death, when the vital strength is decayed, we observe a viscid sweat to be expressed, attended with red, purple, and livid spots, arising from the admission which is given to the thicker liquids by the lesser vessels, and the resolution of the small sphincters, wherewith they seem to keep in the humours, which they contain.

2. If now such applications be made to the vessels that are dilated by a plethora, an increase of motion, or the rarefaction of the liquids, as shall suddenly contract the capacity of the vessels, we are sure that an *error of place* will certainly occur; for the thicker humours, that have entered the dilated vessels, are kept in by their being contracted, so that they can neither be driven backward nor pushed forward through their narrower parts; from whence an obstruction must necessarily follow. If after hard labour a man cover himself up close, and so take rest, all the vessels contracting gradually will by their own strength drive back the foreign humours, which have entered into them; but if the same person were to expose his naked body to the cold wind, a severe pleurisy might arise from it, with other inflammatory and difficult diseases.

3. This diagnosis is confirmed, when the other changes are observed in the disordered functions, which have been described in the numbers cited.

S E C T.

S E C T. CXXXIX.

IT is also easy to foresee what will be the consequence of this disorder, by what has been explained in (120, 122, 123).

When this disorder is once known to subsist, and it is likewise known from what cause it has arose, and in what part of the body it is fixed, it will be easy to foretel the effects which will follow from it. For there is far more to fear from an *error of place* arising from too great a velocity in the circulating humours, than from the same circumstance when it proceeds only from too great a laxity of the vessels: an *error of place* in the vessels of the brain, will be far more dangerous than in the external integuments of the arm, &c. But these particulars have been fully explained in the number referred to. For in §. 120. the general effects of all obstructions have been considered, and in the following §. 121, 122, 123, it has been also explained, what dangers were to be apprehended from this disorder, when formed in the several series of vessels, and in the different parts of the body.

S E C T. CXL.

THE cure is wrought, 1, by driving the obstructing matter backward by a retrograde motion into the larger vessels; 2. by resolving it; 3. by relaxing the vessel; 4. by bringing the matter to a suppuration.

The obstructing mass is fixed in a conical vessel, which is continually growing narrower; so long therefore as the bulk of this mass shall remain the same, and the sides of the obstructed vessel retain the same degree of firmness, the obstacle cannot possibly be thrust any farther forwards into the narrower parts; nothing

nothing therefore is left but to push it backwards by a retrograde motion towards the basis of the conical vessel, that thus it may pass again into the larger vessels. But from the observation of Leeuwenhoeck, mentioned §. 131. numb. 1. it is plain, that the obstructing mass would in this case be often pushed back, and again thrust forwards, and thus continue moving for some time in the obstructing canal; and that the cause protruding it into the narrower part is the impetus of the fluid pressing upon it from behind, which, when it ceases, gives place to the contractile force of the sides of the obstructed canal to drive it back towards a broader place.

That such a retrograde motion of the fluids takes place in the vessels, as soon as the impelling force of the heart ceases, or is diminished, is plain from the most certain observations. When a person falls into a syncope, the action of the heart begins to be diminished; and in case it be a perfect syncope, absolutely ceases. Immediately the lips and eyes begin to turn pale, the face to fall and be contracted, the smaller vessels collapsing, or rather contracting by the elasticity of their sides, and pushing back the fluids they contained into the larger vessels.

Suppose now, for instance, that a red globule, which has entered the orifice of a dilated serous artery, be so fixed there as it can pass no farther; if this very globule be pushed back into the artery charged with red blood, from whence this serous artery was derived, it will freely pass through the extremities of the red artery, and the obstruction will be removed. And the like removal of an obstruction may be wrought in the other series of decreasing vessels.

2. By the definition given in §. 107, an obstruction was said to arise from the bulk of the matter that was to pass, exceeding the capacity of the vessel that was to transmit. If then the obstructing matter could be so divided, as to be made capable of passing through the narrowest part of the obstructed vessel,

The obstruction would be taken away. This method of resolving an obstruction was visible in the experiment of Leeuenhoeck already recited, where the obstructing mass by going backward and forward and rubbing continually against the sides of the canal was so dissolved, as to become capable of passing through it.

3. It is very evident, that the same effect altogether will be produced, whether the capacity of the obstructed vessel be increased, or the bulk of the obstructing mass be lessened; for in both cases a free passage will be obtained for the fluid, that was to be transmitted through the canal that was before obstructed, which was the thing required. And that the vessels may be so relaxed, as not only to admit the grosser humours, but also to transmit them through their extremities, is what we learn from daily experience. The mouths of the open vessels which line the inside of the womb, transmit only a thin liquid resembling dew, at all times when the woman is free from her menstrual discharge; but when she has her menses, they let fall a red blood; and when these cease, they are again contracted, and give no admission to the red blood any longer. It is a common circumstance with many persons, if they be roughly carried over rugged and stony ways, to void pure blood instead of urine, without any pain, not from any rupture, but merely from a dilatation of the *tubuli renales*; and this disorder is cured only by sitting still, and giving time to these tubes to contract, which before were too much dilated.

It may perhaps seem strange, that in §. 118, the relaxation of the vessels should be reckoned among the causes, which gave admittance to the grosser humours into foreign vessels; and yet here the like relaxation of the vessels should be recommended in the cure of the same disorder. But we should do well to consider, that the relaxation of the vessels, which causes the grosser humours to be admitted into the dilated orifices of the vessels, and not transmitted, is the cause

cause of an *error of place*; but that such a relaxation, as causes the grosser liquids that are admitted to pass through the extremities of the vessels, will cure the obstruction that an *error of place* has caused.

4. But now when the obstructing mass is so firmly fixed in the narrow part of the connivent vessel, that it can neither be pushed backward into the greater vessels, nor be resolved by art; and farther, when the obstructed vessel cannot be so far relaxed, as to suffer the offending matter to pass through it, the only thing left is, that the obstructed part be cut off by the vital power, which presses upon the obstructed place from behind; the vessel thus freed, but open, pours out its humours, which mixing with the very tender parts that are cut off, partly by the heat of the place, and partly by the attrition of the neighbouring vessels, form all together an homogeneous, white, thick, fat humour, called *pus*; and this we call bringing the matter to a *suppuration*. This is the only way, by which nature discharges itself of every part, that is so obstructed as not to be resolved. And this operation of nature is always salutary, provided the vessels that are thus to be changed into *pus*, together with the unpassable liquid obstructed in them, are not absolutely necessary to life, and that the *pus* thus formed may be commodiously carried off.

When in the most ardent of all fevers, the plague, a terrible inflammation, attended with so hard a tumour as no art can resolve, shall arise about the axillary or even inguinal glands, by a suppuration about the edges, the whole that is mortified shall be separated from the parts which have life, and fall off, which could never be effected by any art but by suppuration only.

S E C T. CXLI.

THE obstructed matter is thrown back again,
1. by an evacuation of the liquid, which
presses upon it, by large and sudden bleeding,
D d 2 whence

whence it is driven back by the action of the contracted vessel; 2. by frictions directed from the extremities of the vessel towards its basis.

1. When an artery, that has been distended by the action of the heart, contracts itself, it would press back the fluid it contains into a broader place, unless prevented by the impetus of the liquid, which presses upon it from behind; when therefore the quantity of that liquid is diminished, and the force pressing from behind is weakened, the fluid contained in the arteries will be moved with a retrograde motion from the apex towards their base; and thus, so far as concerns the direction of the course of the fluid, the arteries for a time will be converted into veins. Now these effects are both wrought by bleeding, for it both lessens the quantity of blood contained in the vessels, and weakens the force of the impelling heart; for if we please we may weaken by bleeding 'till we kill the man.

But that these effects may be wrought to advantage, it will be adviseable to bleed both largely and suddenly; for if a small portion of blood only be taken away, the quantity will not be sufficiently lessened; and unless it be done suddenly, the force of the heart pressing upon the blood from behind will not be weakened to a proper degree. For a strong man will be scarce able to bear the loss of two pounds of blood, if let out from the vein in a full stream, without fainting; whereas, if it fall drop by drop from the nose, or as it sometimes happens upon pulling out a tooth, if for whole nights and days it shall keep oozing out of a small artery, he shall bear the loss of three times the quantity and not faint at all.

This we have confirmed to us by the circumstances, which have been observed to occur in acute inflammatory diseases. A person sick of the pleurisy cannot draw in his breath, it gives him such excessive pain, and thus he is well nigh suffocated; open a vein in the arm, and you carry off the disorder; even whilst

the blood is flowing out the pain frequently begins to grow less, and sometimes entirely ceases, the obstructed vessels being freed from the load which oppressed them by a retrograde motion of the humours towards the broader vessels. When the eyes are inflamed and look red all over, from the blood which is impelled into improper vessels, if you bleed largely, even to fainting, the redness shall immediately go off, by reason that the blood is pushed back into the larger vessels. For it is by no means requisite, that the obstructing masses should be carried a great way backward by this retrograde motion, before they enter the larger trunks; since we learn from anatomical injections, that very frequent anastomoses and divarications of the trunks into branches, are often found to lie within a very narrow compass.

The antient Physicians, though unacquainted with the circulation of the blood, have yet from the bare observation of effects in diseases, recommended the free use of bleeding in resembling disorders. Galen, in his explanation of the twenty-third Aphorism, §. 1. (a) commends such an evacuation "in very ardent fevers, "in very great inflammations, and in excessive pains," *in febris ardentissimis, in maximis inflammationibus, & vehementissimis doloribus.* And in another place (b), "where there is too great an abundance of over-heated blood, giving rise to a very acute fever, it is convenient to make a sudden and large evacuation; we must even attempt an inanition, till the patient is ready to faint away, regard being always had at the same time to his strength;" *ubi fervercentis sanguinis inest plenitudo, acutissimam accendens febrim, subito ac simul evacuare expedit, eamque inanire tentandum, vel ad animi deliquium usque, virium modo inspecto robore.* What follows after shews plainly, that Galen is here speaking of bleeding, for he directs the Physician

(a) Galen. Comment. I. in Aphorism. Hippoc. Charter. Tom. IX. pag. 40. (b) De curandi ratione per venæ sectionem, cap. 12. Charter. Tom. X. pag. 441, 442.

fician to attend to the sinking of the pulse, by clapping his finger upon the artery, whilst his patient is bleeding, lest he should fall into an irrecoverable syncope; which accident, he says, happened to three Physicians to their great disgrace.

But the symptoms of an approaching syncope, from a large discharge of blood, are very visible; for the pulse becomes less strong and more fluttering, the head grows giddy, the eyes and lips turn pale, the stomach is uneasy, and disposed to give up its contents, and the blood itself flows out of the vessel with less celerity; when therefore these circumstances occur, it will be right to abstain from any farther evacuation.

2. When the impetus of the liquid, pressing upon the obstructing mass from behind, is removed, or at least very much diminished, the contraction of the vessel only then drives back the obstructed matter towards a broader place. Whatever therefore shall increase the contractile force of the vessels, or conspire with it in producing a like effect, will also assist in promoting this retrograde motion. Now friction, by compressing the sides of the vessels, does the same thing as their own contractile force had done, and even adds to the efficacy of the said contractile power, as has been shewn §. 28. numb. 2. and consequently cannot but be useful in this case, especially if it be directed from the extremities of the vessel towards its basis.

The advantage of this practice is farther confirmed by experience. For bleeding will succeed better in a pleurisy, if the side affected be gently rubbed at the same time as the blood is flowing from the vein; or if the patient move the affected part by frequently drawing in his breath as hard as he can, or by coughing; for which reason it is not unusual to provoke to a fit of coughing by a little warm wine, or by holding vinegar under the nose, under a pretence of keeping up the spirits, that by this means the sick may do that undesignedly, which through fear of increasing

sing their pain they could not otherwise be prevailed on to consent to. When animals have been hard hunted, upon taking off their skin, the whole *panniculus adiposus*, and even the muscular flesh, has been found to be turned almost black, from the blood being thrown into vessels which did not properly belong to it; so grooms rub down their horses in the stable after they have been rode hard, in order to prevent this inconvenience; having learnt by experience, that unless they do this, their cattle will grow faint and become altogether unfit for the discharge of their usual exercise.

It was customary with the Antients to advise the use of baths and frictions after a long journey; and this custom still prevails in Asia.

S E C T. CXLII.

THE obstructed matter is resolved by such remedies, as are mentioned in 133, 134, 135, 136.

These have all been treated of in the numbers referred to. It is very remarkable, that though our blood spontaneously coagulates when at rest, yet it shall gradually again turn to a fluid. For the blood let out of the vein of a very healthful man, shall presently be converted into a solid cake; from whence by degrees a thinner serum shall separate, leaving the concremented red mass, by some called the island, to swim within it. Pour off all this serum, and the red thick part shall in a few hours yield a resembling serum a second time, and so on 'till the whole substance shall in great measure be liquified. From whence it seems highly probable, that the obstructing masses, which stick fast in the vessels may by degrees be dissolved in like manner from the heat of the body, provided that the impetus of the fluid pressing upon them from behind be diminished, and there be not so great a firmness in the vessels as shall condense the fluid too much.

S E C T.

S E C T. CXLIII.

THE vessels are relaxed by the remedies recommended in 35, 36, 54.

S E C T. CXLIV.



THE business of suppuration will be treated of more largely under the subject of inflammation.

Thus have we explained the most simple diseases, which are found to subsist in the solid parts of the human body, to wit, the too weak or too strong cohesion of their particles to each other, without any consideration of the fluids. We next proceeded to the fluids, and have considered the several disorders to which they are spontaneously inclined. From hence we advanced to the most simple diseases, which have been observed to occur in the solids and fluids taken together, such as too quick or too slow a motion of the fluids through the vessels, and to them we have farther added the effects of a plethora, or too great redundancy of good humours. And, lastly, we have treated of an obstruction, as it owes its original to something amiss in the solid or fluid parts, or in both together.

It now follows, according to the order set down in §. 16. that we treat of the cohesion of parts dissolved, that is, of a wound. For every considering person will plainly see, that all these particulars were necessary to be premised, before the history and cure of a wound could be treated of in due manner.

The End of VOL. I.